THE SAFE ENERGY JOURNAL

SCRAM

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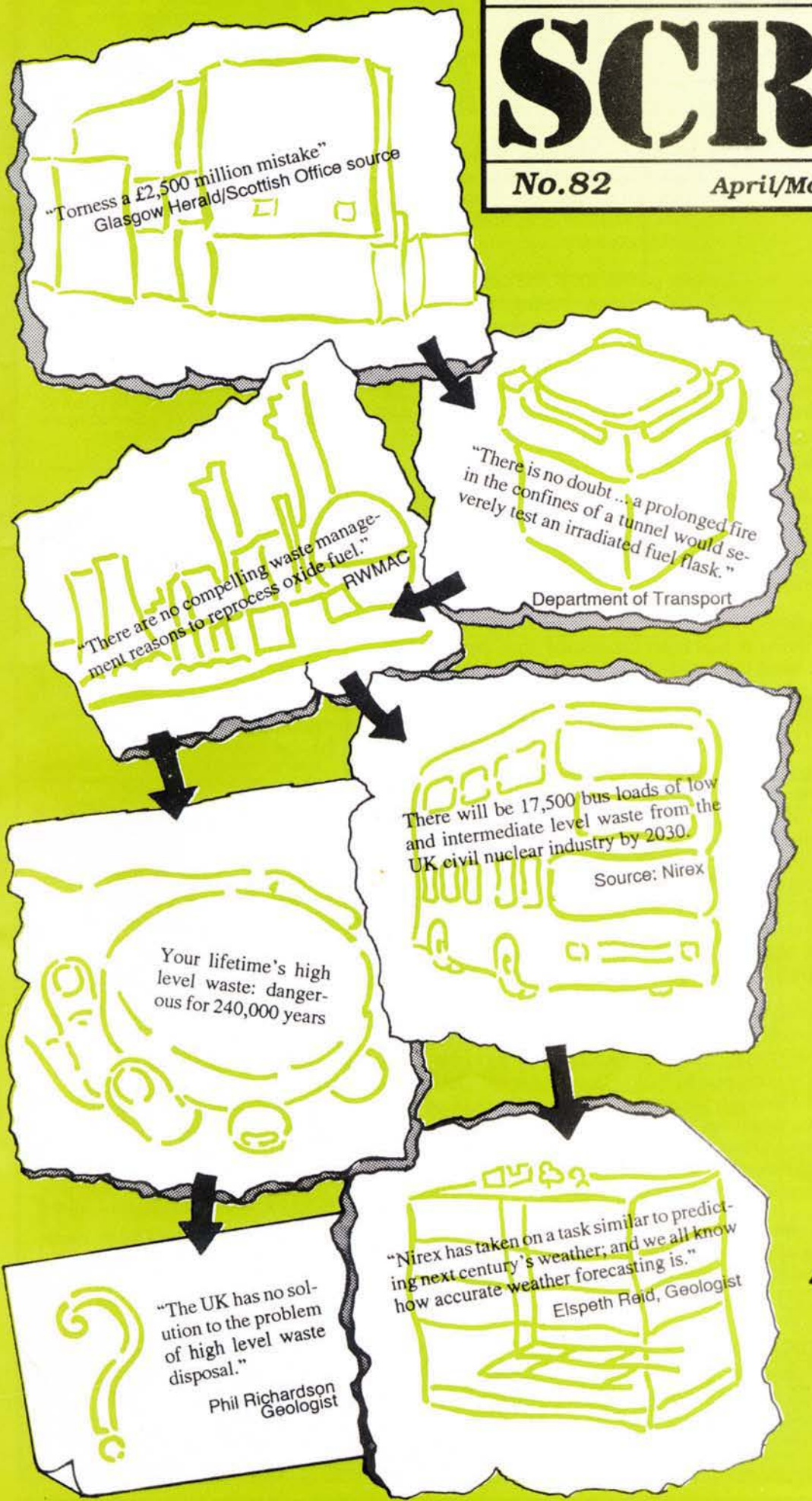

Genetic effects of radiation

The state of the environment

Making the connections

Removing the wind brakes

The future of reprocessing

High level waste management

4 page pull-out: Dounreay and nuclear waste dumping

COMMENT

CONTAMINATION was found on the first waste flask to successfully arrive at Dounreay since the announcement that they were scouring the world for contracts to reprocess spent highly enriched uranium fuel – a classic example of foot shooting if ever there was one.

Dounreay is infuriated by the way the anti-nuclear movement, with the help of the media, have linked the reprocessing contracts to the Nirex dumping issue. But whatever they say, you cannot escape the fact that reprocessing increases the volume of waste by something like 160 times, and the bulky low and intermediate waste will probably stay in this country.

The writing has been on the wall about nuclear power for some time now, but certain politicians continue with their blinkered policies, driving us all further into a technological cul-de-sac, potholed with an ever increasing number of contamination 'incidents', near-misses, accidents, and disasters. For instance, Norman Lamont failed to deliver the expected boost to energy efficiency that removing VAT from efficient appliances would have brought; and George Bush, who took the world to the brink of nuclear conflict in the Middle East, has not only failed to learn any lessons from the Gulf War, but appears to have put any sensible policies he did have into reverse.

Japan, one of the few countries in the world still enthusiastic about nuclear power, has been the latest victim of a near miss. "This matter cannot be disposed of by saying there was no significant release into the surrounding environment" says Dr Takagi of the Citizen's Nuclear Information Centre in Tokyo. The Mihama-2 reactor nearly had a meltdown – less than 5 years after Chernobyl!

The Japanese are still demanding their plutonium back from European reprocessing plants, at a time when it has been confirmed that yet another country, this time Pakistan, has joined the ranks of nuclear capable nations. The Gulf War nearly went nuclear, not because Iraq, with its stocks of weapons grade uraniumfrom France, was anywhere near launching a bomb, but because Israel was quite prepared to use its 150 nuclear weapons if attacked with chemicals.

It is time to draw the world back from the brink. Out of disaster comes opportunity, and at the present time there are more positive signs worldwide than we have seen for some time. The Japanese must now surely be going through a re-evaluation of their nuclear ambitions. The Germans are amending their Atomic Act to remove the bias in favour of reprocessing. The European Parliament are carrying out an investigation into the transboundary movement of nuclear waste. The non-proliferation treaty will be reviewed again in 1995 – we must seize this as an opportunity to stop the movement of plutonium, and highly enriched uranium around the world, but the UK and US also need to end their objection to a Comprehensive Test Ban Treaty.

We must all play our part, how can we expect the struggling East Europeans to shut down their unsafe Soviet-designed reactors, if we in the UK cannot show them the role that energy efficiency and renewables can play? How can we expect developing countries to continue to eschew nuclear weapons, if we can't even sign a test ban treaty? How can we expect the Japanese to abandon their plutonium fuel cycle plans, when we insist on opening THORP, despite its loss making potential? How can we expect anyone to take our plans to cut CO_2 emissions seriously, when we give our newly privatised electricity companies the task of selling as much electricity as possible?

The environmental approach is eminently sensible – what is most astounding is that the nuclear/gas guzzling approach doesn't even have any short-term benefits. Let's all get out there and knock a few politicians heads together now!

On a more personal note, at SCRAM we are about to lose the services of our nuclear editor, Pete Roche, who is off to take up a post as Civil Nuclear Campaigner at Greenpeace in London. Pete helped start up SCRAM in 1975, and worked full-time in 1977/8 and 1981/2. This time he has worked for us for four years. We shall miss him, and thank him for all his hard work.

scram, *skram, v.*
to shut-down a nuclear reactor in an emergency.

The ***SCRAM Safe Energy Journal*** is produced bi-monthly for the British Anti-nuclear and Safe Energy movements by the **Scottish Campaign to Resist the Atomic Menace (SCRAM)**. Views expressed in articles appearing in this journal are not necessarily those of SCRAM.

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We welcome contributions of articles, news, letters, graphics and photographs; which should be sent to **SCRAM** at the address below.

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THE SAFE ENERGY JOURNAL

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CONTENTS

FEATURES

Four page pull-out Broadsheet: Dounreay and nuclear waste dumping

Japanese near-meltdown

ON 9 February the Mihama-2 reactor was the scene of Japan's worst ever reactor accident, writes **Don Arnott**. The 500MWe Pressurised Water Reactor (PWR) opened in 1972, and is situated on the coast near Fukui, about 200 miles west of Tokyo.

Early reports were inevitably confused, but, over the subsequent days, because of detailed reports in the Japanese press, and the no-cover-up policy of the Fukui Prefectural Government, it was possible to piece together what happened.

The accident originated in the steam generator with a pipe rupture in the primary circuit. This circuit contains water heated in the reactor core to about 300°C and at a pressure of about 2000 psi (pounds per square inch) which is used in the generator to form the steam which drives the turbines. A rupture of the primary circuit has two certain consequences: depressurisation of the core, and contamination of both steam generator and turbine with radioactivity contained in the primary circuit. The extent of both depends on the severity of the break.

The facts so far available suggest that this break may have happened relatively slowly. At 12.40pm, with the reactor at full power, a technician apparently on a routine check, noticed that the radioactivity in the secondary (ie. steam) circuit of the generator had risen slightly. This should have been taken as evidence of a leak, but the instrumentation was assumed to be faulty. At about 1.40, the level of activity started to rise sharply; within 5 minutes it had increased tenfold whilst at 1.50 it was 1250 times the normal level. At this point the reactor automatically shut itself down by triggering the Emergency Core Cooling System (ECCS), which flooded the core with water about two minutes after the staff had themselves started to reduce power.

Three mile island re-run

Immediately after the ECCS was triggered, the staff apparently made efforts to depressurise the core further by trying to open the Pressure Operated Release Valve (PORV). But the PORV was stuck (a remarkably frequent accident despite the success of a similar device on steam locomotives during the last 150 years); fortunately, this one was stuck in the closed position. For, although the intention was to reduce the flow through the break, the consequence might have been massive and sudden depressurisation of the core, formation of a steam void, partial uncovering of the fuel - in other words a re-run of Three Mile Island (TMI-2).

One disturbing feature is that not a single document mentions the reactor scramming (shutting down in an emergency). This should have happened on depressurisation, as at TMI-2, 8 seconds into the accident. Hopefully this is merely an omission. The fact remains that reactor pressure dropped suddenly from 157 atmospheres (atm) to 128 towards the end of the incident, before the ECCS kicked in; and this should certainly have precipitated a scram.

The general picture is consistent with an initial crack finally shaking itself apart into a full-width pipe break as a result of the intense mechanical vibration which inevitably accompanies the movement of water under such huge pressure. With commendable speed the technicians isolated the fault and a photograph of it appeared in the ***Japan Times*** on 16 February. Although the caption still speaks of a crack, the picture is clearly of a full width break; which was admitted shortly afterwards.

Had the rupture occurred with a bang instead of gradually, it is all but inevitable that adjacent tubes would also have been ruptured. The result could have been extremely rapid core depressurisation with the distinct possibility of a meltdown starting, culminating in a steam explosion when the ECSS was automatically activated. If by that time the control rods had not scrammed, the situation would have been still worse.

'Radioactive plume'

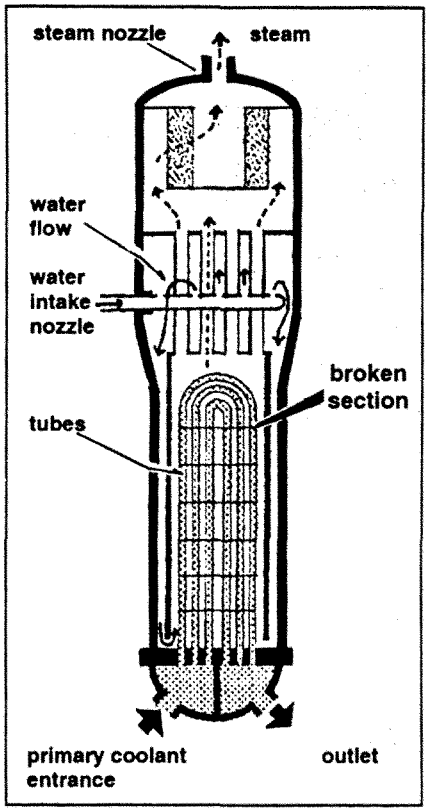
It is said that 20 tons of water escaped from the primary circuit. This may well be an underestimate: about 10 tons of water is forced through a PWR core of that megawattage every second. This is important because it has been admitted that radioactive water escaped into the estuary, which contains one of Japan's flourishing fish farms.

There is, so far, no evidence of fission product release through fuel damage. On that assumption the radioactivity would have consisted of neutron activation products arising from impurities in the primary circuit and Cobalt-60 (half-life 5.3 years) from the Inconel tubing of these pipes.

Though worrying enough, neutron activation products do not stand comparison either in quantity or hazard with a fission product burst. The ***Guardian's*** report (13/2/91) of "a radioactive plume nine miles long and two miles high" has yet to be substantiated. It is even harder to believe that "a US satellite put up to detect clandestine atmospheric nuclear tests" could detect activation products non-explosively released. A small air leak has been admitted, but its origin is obscure at present. Perhaps there was a fission-product explosion - we are only at the beginning of the Mihama-2 story - but there is no evidence of it so far.

Despite the uncertainties, two things are clear:

1. Once again it has been shown that the weakest and potentially the most dangerous part of the PWR is its heat exchanger. This is true also of gas-cooled reactors and for the same reason - the output temperatures are so low that huge heat exchangers are necessary to obtain an adequate head of steam. Each contains hundreds of yards of piping and thousands of welds - all vulnerable to corrosion and unending vibration.



Steam generator

The record of the Mihama-2 exchanger alone is shocking. It is in duplicate and the two together contain, in the primary circuit, over 7000 thin Inconel tubes 2.2cm diameter and about 6 metres long. At various times over 400 of these (5.7%) have been permanently blocked off due to cracks. It is claimed that this makes no difference to the efficiency of the exchanger. The tubes are inspected annually, and were last checked 6 months before the accident.

15 of the 17 PWRs in Japan have, between them, lost 7592 tubes in this fashion. All these heat exchangers were a Westinghouse design, though built mostly by Mitsubishi. These problems are not confined to Japan; a similar leak occurred in 1987 at North Anna, USA; and in March 1990 Duke Power started an action against Westinghouse over their steam generators.

2. Once again, plant operators made mistakes. Only within limits can one plan for an accident. It happens out of the blue. Surprise, disbelief, shock and misjudgement are unavoidable human responses.

This was a dangerous accident - perhaps more so in its implications than in its immediate consequences. More will be heard of it. □

Japan: accidents 2, 3 & 4

SINCE the Mihama-2 accident (see page 4) there have been three more accidents in Japan. With four accidents occurring in the space of 2 weeks, serious concerns are now being raised about the Japanese Government's ambitious nuclear programme.

The second accident occurred on 21 February at Kariwa-2 in Kashiwazaki, Niigata Prefecture. A steam turbine stopped after the output of a lubrication pump dropped suddenly. Tokyo Electric Power claim no radioactivity was released.

The third accident happened on 22 February at the Onagawa boiling water reactor. A leak of radioactivity which, according to Japanese nuclear safety officials, was contained within the plant, occurred due to problems with a bolt connecting steam pipes.

Then on 23 February, there was a small leak at an experimental station for testing the safety of vitrified high-level waste for underground storage, at Tokai Mura.

Ministry of International Trade and Industry (MITI) officials are now concentrating their efforts on a £13million a year publicity campaign to increase public support for nuclear power. Despite the shadow cast over Japan's nuclear ambitions by this spate of accidents, two weeks after the Mihama incident, a pro-nuclear candidate for a seat in the Diet in the northern prefecture of Aomori won a decisive victory over his anti-nuclear rival. One of the biggest issues in the election campaign was the plan to build a reprocessing plant at Rokkasho.

■ As we go to press, Channel 4 News have reported a 5th accident, similar to Mihama-2. More details next issue. □

TUs and Energy Policy

THE Socialist Environment and Resources Association (SERA) Energy Group are organising a conference on Trade Unions and Energy Policy. To be held on 27 April at the Conway Hall in Red Lion Square London, speakers will include Simon Roberts (FoE), Arthur Scargill, Dave Elliot (NATTA), Ken Cameron (FBU) and Frans Berkhout (SPRU).

SERA's Energy Group are calling on people to write to Labour MPs asking them to work for a Labour manifesto commitment to scrap THORP and Sizewell B. SERA also want Labour Party members to propose resolutions for the Autumn conference. □

Further details available from Dave Toke, 215 Hubert Road, Selly Oak, Birmingham, B29 6ES (Tel 021-472-8095).

German atomic law

AN amended German Atomic Act, which is expected to be passed by the Bonn Parliament by the end of this year, will give German utilities greater freedom to choose between spent fuel management options. The current act has a legal bias in favour of reprocessing.

German utilities have contracts with British Nuclear Fuels (BNFL) for 760 tonnes of spent fuel to be reprocessed at THORP between 1993 and 2002. These contracts are binding on the customers. However, an amended Atomic Act could seriously affect the commercial viability of THORP, because of the damage it could do to its post 2002 market. The new agreements with German utilities to reprocess up to 1,600 tonnes of spent fuel between 2002 and 2012, signed after the abandonment of Wackersdorf, are only options. The German utilities can decide not to take up the available reprocessing options if a more attractive disposal route is available.

The chair of the powerful RWE utility, Friedhelm Gieske, said, at the end of 1989, that German utilities were "by no means ideologically committed to reprocessing". Utilities were forced into contracts "because without the option of spent fuel disposal, we have no other way" of meeting the present reactor licensing requirement of six forward years of spent fuel management.

■ Meanwhile the West German utilities RWE-Energie, Preussenelektra and Bayenwerk are planning to build two nuclear power stations in east Germany, on the two existing sites at Greifswald and Stendal. No more work will be carried out on the existing stations, whether formerly in operation or under construction, because it would be impossible to bring them up to western safety standards.

Work on the new plants is expected to start in 1993, although the plans have yet to receive the necessary clearance from the Environment Minister, Klaus Topfer.

The opportunity which the new conservative/liberal Government had, to show that it could meet both energy demand in east Germany and its ambitious CO_2 emission targets by "improving energy efficiency ... and expanded use of renewable sources", appears to have been unceremoniously dumped (*SCRAM 80*). □

Wylfa dry store wet

FUEL rod corrosion problems, caused by a leaking roof at the Wylfa dry store on Anglesey, have led to speculation that the nuclear utilities' plans to build similar stores, as an alternative to reprocessing, may be scuppered.

Environmentalists, however, say the fuel corrosion problem has become severe because the leaking roof remained undetected for so long, and blame the lack of monitoring.

The roof leak has, according to *Construction Weekly* (20/2/91) "raised doubts that such concrete buildings have the necessary structural integrity to house lethally radioactive material for periods of up to 100 years". The leak, discovered last July, had clearly been going on for some time, as it has now emerged that at least 46 spent Magnox fuel elements have been corroded. If water penetrates the cladding of the element it can react with the metallic uranium fuel and form uranium hydride which can ignite spontaneously in air.

Nuclear Electric announced at the end of February that they have not detected uranium hydride. Ideally engineers would like to remove the damaged fuel as soon as possible and send it for reprocessing. However, special equipment will have to be designed to recover the fuel from the store. Some of the elements are too fragile to be moved. Existing safety regulations rule out movement of such badly damaged fuel by road or rail in the usual water-filled flasks.

Existing monitoring systems failed to indicate that there was any problem. The corrosion only came to light when, during normal operations to move fuel around in the store, a 'lifting button' from one of the elements emerged with no fuel attached.

A source at GEC, the company that designed the Wylfa store, told *Construction Weekly* that the new designs for Nuclear Electric and Scottish Nuclear were "a completely different ball game". Jim Grant, Scottish Nuclear's engineering director says "our designs didn't have a flat roof".

Some sections of the press have seen the problems at Wylfa as being a major embarrassment for environmental groups because of their advocacy of dry storage as an alternative to reprocessing and dumping. However, the fact that the corrosion was discovered and can now be dealt with, surely proves the advantages of above ground storage over deep disposal. Had corrosion led to radioactivity leaking out of a sealed underground repository, there would be nothing we could do about it. It is also clear that dry storage requires proper and sufficient monitoring, so that spent fuel can be retrieved well before corrosion becomes as severe as is now apparent at Wylfa. □

Radioactive Solway

SEA to land transfer of radionuclides on the Scottish coast off the Solway Firth results in doses well within the internationally accepted limit, according to a new computer modelling study*. The study, carried out by the Atomic Energy Authority (AEA) on behalf of the Scottish Office, modelled the radiological impact of Sellafield-derived radionuclide transfer in sea spray in Dumfries and Galloway over the period 1950 to 2050.

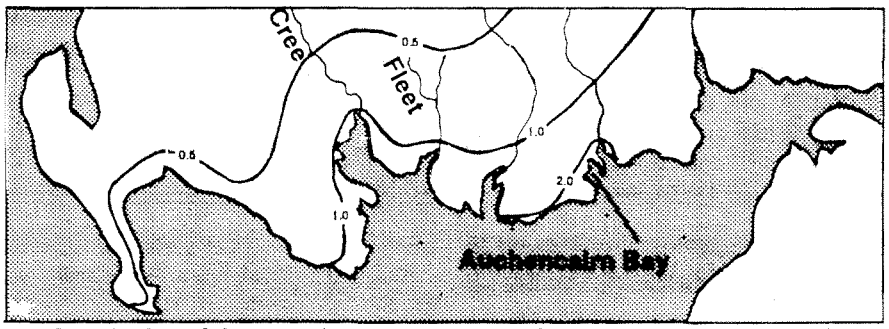
This AEA modelling study, however, did not look at the transfer of radionuclides to the land by tidal inundation. "This pathway," the report admits, "gives rise to levels of radioactivity in soil which are substantially higher than those resulting from sea spray".

A 1989 report by the Scottish Universities Research and Reactor Centre (SURRC) found tidal inundation upriver to be a much more effective mechanism for transferring radionuclides from sea to land (*SCRAM 73*). Radionuclides were detected 17.5km upriver, although they were restricted to an area only a few metres on either side of the river course. Two soil samples, taken by SURRC from the banks of the Rivers Cree and Fleet, were found to exceed the official safety limit. SURRC called for a review of critical group doses in areas where the riverbank is accessible to grazing sheep and cattle. Further studies into the tidal inundation pathway are currently being undertaken.

By contrast, the AEA report says radionuclides transferred by sea spray are known to penetrate many kilometres inland, albeit at low levels, thus affecting large numbers of people.

The maximum annual dose, received by an average individual at Auchencairn Bay, is calculated to have happened in 1973 at the time of peak plutonium discharge, and was 2.8μSv. The annual dose in 1989 is calculated to have dropped to 0.8μSv, with a further reduction to 0.4μSv by 2050. Doses to members of a hypothetical critical group are calculated as 3.7μSv in 1973; 1.5μSv in 1989 and 1.0μSv in 2050. (The NRPB's recommended annual dose limit is 0.5mSv = 500μSv). Interestingly future doses are calculated on the assumption that there will be zero discharges after 2000. □

* *An Assessment of Radionuclide Transfer in Marine Aerosol to the Environment of Dumfries and Galloway*, **by Jim Howorth, AEA Environment and Energy. DOE Report No. DOE/RW/90.073.**



Distribution of doses to the average person, from sea-to-land transfer of actinides in 1973 in μSv per year

Indian flask farce

A flask, containing 40 Highly Enriched Uranium (HEU) spent fuel elements, was found to be contaminated on its arrival at Dounreay from India. The flatbed transporter was also contaminated, as were the transporter and cradle off-loaded from the ship at Felixstowe.

The UK Atomic Energy Authority (UKAEA) 'rented' the fuel to the Apsara pool reactor, operated by the Bhabha Atomic Research Centre in Bombay, under a 1964 contract. The return of the fuel for reprocessing at Dounreay represents the end of the contract.

The flask was monitored, in accordance with International Atomic Energy Agency regulations, and certified as clean by Indian nuclear authorities before being loaded onto the cargo ship, Vishva Parijat. The ship left Bombay on 24 December 1990 and arrived at Felixstowe on 30 January.

At Felixstowe the flask, resting on a cradle and flatbed transporter was off-loaded. It was then loaded onto another flatbed transporter and driven by lorry to Dounreay, where it arrived on 1 February. The original cradle and transporter remained on the docks.

When the lorry arrived at Dounreay, the flask and transporter were washed down in a 'non-radioactive area' and the flask photographed for publicity purposes. It was only on 4 February that the flask was monitored - for the first time since it left the Indian reactor over 6 weeks earlier. Contamination was found on the flask and transporter, and the run-off in the 'non-radioactive area' was also found to be contaminated.

The cradle and transporter, which had been sitting at Felixstowe docks for nearly two weeks, were later also found to be contaminated, and were taken to Harwell. No figures on the levels of contamination have been released.

The flask involved in this shipment was a Unifetch 'Total Containment' flask. This means that (in theory) it is impossible for the flasks to leak - there is not even a safety valve to allow venting in the event of a dangerous build up of pressure, as this would invalidate the IAEA's total containment certification. Thus the nuclear industry refuse to accept the possibility of the flasks leaking, except in some catastrophic circumstances, otherwise they would call into question the whole concept of 'total containment'. Independent experts believe flasks can and do leak through the seals, for example when there is a build-up of pressure.

While this incident did not form part of Dounreay's aggressive world-wide drive for new contracts to reprocess HEU fuel from research reactors, it clearly illustrates the type of shipments involved, the threats they represent, and the lack of safety regulation. □

Report on Transportation of Spent Fuel from India to Dounreay* **by the Northern European Nuclear Information Group, February '91, and *An Analysis of Dounreay Reprocessing Contracts* **by Pete Roche, February '91, both available from SCRAM for £1 incl. p&p.**

Marine insurance limited

THE world's leading marine insurance markets have introduced a clause into their policies excluding coverage of accidents involving radioactive contamination because they fear claims may far outstrip their ability to pay.

A two-year study by the International Union of Marine Insurers (IUMI) in the wake of the Chernobyl accident concluded that an accident in the crowded southern part of the North Sea could cost in excess of $7bn. Scores of vessels and oil platforms could be seriously contaminated with radioactivity.

Insurers fear that a Chernobyl-like nuclear explosion at a coastal nuclear plant or a leakage during the transport of nuclear waste could cause widespread damage at sea. The new clause excludes any liability for damages resulting from "contamination by radioactivity from any nuclear fuel, or from any nuclear waste, or from the combustion of nuclear fuel".

This decision brings marine insurers into line with the nuclear accident exclusions long made by non-marine insurance companies. The liability will now fall, for the first £20m, on the organisation responsible for the nuclear plant or the movement of nuclear material. If claims exceed £20m, the Government will make £200m available. In the event of a major accident, such as the one envisaged by IUMI, claims exceeding £200m could only be approved by Parliament. □

Non-proliferation failures

INTERNATIONAL attention has been focused on the failings of the nuclear Non-Proliferation Treaty (NPT) by the Gulf War and the debate about Iraq's nuclear ambitions.

The NPT which came into force in 1970 aims to prevent the proliferation of nuclear weapons, achieve disarmament in the Nuclear Weapons States (NWSs), and bring a permanent halt to all nuclear tests. A further goal is to promote the peaceful use of nuclear power. 82 countries have signed the Treaty, and in 41 countries the International Atomic Energy Agency (IAEA) conduct inspections to make sure no nuclear materials are diverted from peaceful to military uses.

Every 5 years a Treaty Review Conference is held in Geneva. The fourth such conference came and went late last summer, virtually unnoticed by the western media in the midst of the Gulf Crisis. Most non-weapons states believe the best way for the NWSs to fulfil their part of the bargain would be to negotiate a comprehensive test ban treaty (CTBT). The UK and US have refused.

NATO used to argue that nuclear weapons were the only effective counter to Soviet conventional superiority, but with unilateral withdrawals and the treaty on Conventional Forces in Europe, nuclear proliferation is now a much more real threat to World Peace than Soviet conventional power.

The ***Financial Times*** argues "to go on asserting that [nuclear weapons] are indispensable to a state's security against conventional attack simply incites more and more states to seek to acquire them", Britain and the US "should move to conclude a comprehensive test ban treaty ... as soon as possible".

Non-signers

Many nations, including France, China, Israel, India, Pakistan, Argentina and Brazil have refused to sign the NPT. Despite the fact that it makes economic sense for the World to rely on just a few uranium enrichment, fuel fabrication and reprocessing facilities, some nations are loathe to rely on a system that they see as simply guaranteeing the nuclear monopoly of industrialised countries.

Those countries that have developed nuclear technology independently, such as China, India and Argentina, have found that enormous resources are required. This has spurred fears that these nations may be eager to recoup some of their costs by selling nuclear equipment to countries outside international controls.

Another fear is that with internal customs barriers due to fall in the European Community at the end of 1992, controlled materials may be moved from countries with strong proliferation controls to ones with weaker controls before export to a country with nuclear ambitions. The easing of restrictions on the flow of strategic goods to Eastern Europe may also create problems because there may not be sufficient controls to prevent equipment being re-exported.

After India exploded a nuclear device in 1974, the US brought together, in London, the majority of nations then able to supply nuclear technology. This club of countries, known as the London Nuclear Suppliers Club (LNSC), agreed to limit sensitive nuclear exports, but could not agree on 'full-scope safeguards' (ie. suppliers insisting that all of the purchasing nation's nuclear facilities are included in a safeguards agreement with the IAEA). In 1976 the LNSC did agree that exported facilities and materials should be covered by safeguards, even if other parts of the purchasing nation's nuclear programme were not.

In 1978 the US passed the Nuclear Non-proliferation Act. This required the Departments of Energy and Commerce to draw up a list of commodities which, if exported, could be of proliferation concern. This Nuclear Referral List currently includes about 65 commodities (eg. certain forms of beryllium, certain types of pipes and valves). However, this system has two important flaws. Firstly, the Commerce Department does not have the resources to verify the end-use of every item exported which could have a dual-use. Secondly, the system is only as effective as the weakest link. If other potential suppliers do not exercise the same restraint, non-proliferation objectives will not be achieved.

Full-scope safeguards call

The 1990 NPT Review Conference called on supplier states to adopt 'full-scope safeguards', and Germany has now agreed to do this. But other important supplier countries such as the UK, USSR, Belgium, France and Italy want unanimous adherence to the principle first.

Nucleonics Week, a pro-nuclear industry magazine, is optimistic that by the 1995 conference there will be a consensus on 'full-scope safeguards'. France acquired a reputation in the 1970s for being lax on nuclear proliferation. They have since cancelled reprocessing plant contracts with South Korea and Pakistan. During the 1980s German exports helped clandestine nuclear programmes in Brazil, Pakistan, Iraq and India. Now Germany claims to have the toughest regulations in Europe.

There can be no doubt, however, that the spread of so-called peaceful nuclear technology has assisted the spread of nuclear weapons. Following the Israeli air attack on Iraq's Osirak (Tammuz-1) reactor in 1981, IAEA safeguards inspector Roger Richter resigned his post. He said "the most disturbing implication of the Iraqi nuclear programme is that the NPT agreement has had the effect of assisting Iraq in acquiring the nuclear technology and nuclear material for its program by absolving the co-operating nations of their moral responsibility by shifting it to the IAEA".

In 1975 Pakistan began obtaining technology for a uranium centrifuge plant. By early 1978, US satellites showed that full-scale construction was underway. By the end of 1986 it was producing weapons-grade uranium. Since then Pakistan is assumed to have produced enough fissile material for between 2 and 4 weapons per year. Over this period, US-led technology control measures by supplier countries delayed, but did not stop, Pakistan's progress. The US has now halted foreign aid to Pakistan because President Bush was unable to certify that Pakistan does not possess a nuclear device.

Previously both the Reagan and Bush administrations had turned a blind eye as Pakistan advanced towards nuclear capability, because the country played a pivotal role in supplying Afghan rebels. Fortunately, there is now evidence of renewed US interest in non-proliferation. US Secretary of State, James Baker, said recently "the incipient nuclear programmes of Iraq and North Korea are the best argument that our non-proliferation effort needs a new impetus to cope with a new danger".

Iraqi bombing

However, the bombing of Iraq's reactors by the US showed an ominous lack of confidence in the NPT and was a gross violation of the Treaty. UN sanctions and tighter export controls made the climate for Iraq's pursuit of the bomb much harsher than for Pakistan a decade earlier. Germany, the source of much of Iraq's nuclear technology has new export controls. Brazil, which has given both nuclear and missile assistance to Iraq had suspended co-operation. The US could have pressed the IAEA to carry out special inspections of Iraq's suspected nuclear research sites. The special authority which the IAEA has to carry out such inspections has never been exercised.

The 1995 NPT Review Conference will have to decide whether the Treaty will continue in force indefinitely, or be extended for an additional fixed period. This conference should be used as an opportunity to strengthen the global non-proliferation regime. Ultimately there can be no guarantee of peace until nuclear power, and reprocessing and uranium enrichment plants in particular, have been phased out worldwide. In the meantime NWSs must urgently adopt a long-overdue CTBT. The IAEA's safeguards functions should be strengthened and sanctions imposed on violators of non-proliferation commitments. The Agency should end its role as a promoter of so-called peaceful nuclear power. □

Official risk estimates covering exposure to ionising radiation take no account of possible genetic defects occurring. Dr PATRICK GREEN, FoE's radiation campaigner, asks why, when a link between ionising radiation and genetic defects was first demonstrated in 1927, more research has not been done. He also reports on two studies, one by Martin Gardner, which could provide powerful evidence for the link.

Genetic effects of radiation

SINCE 1983, elevated rates of childhood leukaemia have been reported around a number of British nuclear installations, in particular Sellafield, Dounreay, Aldermaston, Burghfield and pre-1955 built nuclear power stations. However, simple geographical associations don't prove a causal link with these plants. Both the nuclear industry and its regulators have consistently argued that the doses received by the victims would have been too small to account for the observed incidence of leukaemia. Consequently, even though considerable scientific uncertainty was attached to these exposure estimates, the industry argued that it was not responsible for the leukaemias.

This argument was, however, severely weakened in February 1990 with the publication of the Gardner study, which reported an association between paternal pre-conception radiation exposure and children's leukaemia risk.[1]

What is particularly important about Gardner's study is that a genetic mechanism is implied for the expression of the risk – that is, the fathers radiation exposure leads to some form of damage, or change, in the genetic material transmitted to his children.

This was reported as a completely new and unexpected finding. An excess of childhood cancer amongst the offspring of the Japanese atomic bomb survivors has not been seen.[2] In fact, no significant excess of any type of genetic damage has been seen in this population, or in any of the other populations used to provide information on the risks of radiation exposure. The vast majority of our information on the genetic risks is derived from animal studies.

This lack of information is reflected in radiation safety standards which do not take account of the probability of genetic damage occurring in offspring of those exposed. Radiation dose limits are based upon the risk of developing a fatal cancer in the exposed individuals and not in their children. Before the publication of Gardner most authorities considered that genetic risks had been adequately assessed and if anything overestimated. This has not changed with the new ICRP recommendations, despite Gardner's findings. The ICRP, the nuclear industry and its regulatory authorities still consider that genetic risks are small compared to the fatal cancer risks faced by radiation workers or members of the public.

The lack of confirmation for Gardner's findings in the atomic bomb survivors led many commentators to suggest that Gardner, therefore, must be wrong. For instance, one geneticist working with the US Government's Oak Ridge National Laboratory has been quoted as commenting: "It is completely impossible to conclude that the increases in childhood leukaemia resulted from radiation exposure of the fathers".[3]

Another scientist from the Radiation Effects Research Foundation, the joint US-Japanese funded institute studying the atomic bomb survivors, comments: "the estimated paternal doses to the Sellafield workers are too low to result in the end point being discussed, ie. childhood leukaemia".

Gardner support

Two other human studies have also suggested a link between paternal pre-conception exposure and childhood leukaemia. The first, published in 1966, was mainly concerned with maternal exposure. However it also pointed to an association between pre-conception diagnostic paternal and childhood leukaemia that was of "borderline significance".[4] The second was a case-controlled study in Shanghai published in 1988.[5]

Other scientists have argued that if genetic damage is occurring then an increase in congenital malformations would be more likely than an increase in childhood leukaemia.[3] However, some experimental work on mice suggests that both types of disease may be induced in offspring. This work, by Nomura, was cited by Gardner as support for his observations. Nomura suggested that paternal exposure induces heritable tumours in first and second generation progeny as well as genetic anomalies. These tumours were mainly of the lung, although lymphocytic leukaemias were also found.[6]

Obviously, Gardner's work has yet to be confirmed at other installations with excesses of childhood cancer. Nevertheless, Nomura's experiments pose a further question. Does occupational or environmental exposure to ionising radiation lead to an increase in rates of genetic disease, and if so is this also associated with childhood cancer? The nuclear industry, no doubt, would argue that this would not be the case.

The suggestion, however, is not that unreasonable. Some work conducted in the 1960s by American epidemiologists, suggests that clusters of childhood cancers and congenital malformations may occur together.[7] It is also known that some people with particular congenital malformations, such as children with Downs Syndrome, are at an increased risk of developing leukaemia. Thirdly, similar biological mechanisms, related to somatic and germinal mutations, may be involved in the etiology of both categories of diseases.

Consequently, as well as of looking for further associations between radiation exposure and childhood leukaemia, it might be profitable to look for evidence of an increased risk of congenital malformations amongst offspring of radiation workers, or amongst populations living around nuclear installations.

Astonishingly, hardly any work has been done in this area! This might seem incredible seeing as a link between ionising radiation and genetic damage was first demonstrated in 1927, but it is true.

In 1955 a study was published that compared the rates of genetic diseases amongst 3,751 US Radiologists and a similar population of medical specialists who were not exposed to radiation. The information was obtained by questionnaire, with a 74% response rate for the radiologists and 54% for the non-exposed control group. The majority of respondents were male. The study found a consistent trend of higher rates of abnormality in the exposed group. The study, which made no attempt to assess the doses received by the radiologists, concluded: "The differences are not of large magnitude and in them- selves would not be viewed with alarm. These abnormalities occur, however, in the first generation of offspring and visible first generation effects represent only small fraction of the total damage that may have been inflicted".[8]

Surprisingly, similar large scale studies of congenital malformation rates amongst other populations of radiologists have not been conducted. In the UK, the Office of Population Census and Survey's collects data on rates of malformations, and regulation published reviews of regional trends. In 1985 it also published a survey of rates between different occupations for the years 1980-1982. For female radiologists the data was strongly suggestive of an increased incidence for a number of classes of malformations (cleft lip and cleft palate; tracheo-oesophageal fistula, oesophageal atresia and stenosis; and Downs Syndrome).

The results for one particular class, rectal and anal atresia and stenosis, were statistically significant. This report did not provide a breakdown into classes for male radiologists, but for all malformations together the result also suggested an increased incidence.[9]

Anecdotal data

Obviously, data such as this is only anecdotal and should be interpreted with caution, particularly in view of the small time-scale and small number of cases involved. However, this data, along with the US radiologists study, does indicate a medical trend which should be investigated. For instance, in the UK there are around 10,000 members of the College of Radiographers, yet no one has ever conducted a study into the rates of congenital malformations amongst their offspring.

A number of other studies have looked at the relationship between Down's Syndrome and radiation exposure. Most of these are concerned with the effects of medical diagnostic X-irradiation, mainly to women. Again, these studies point towards a correlation, although some of the evidence is contradictory.[10]

Only two studies have ever been conducted of congenital malformation rates amongst nuclear workers and in the surrounding communities. Both of these were published in 1988 and are by the same author, Lowell Sever. They were concerned with the Hanford Site in Washington State, which was built in 1943-44 to produce plutonium for the US atomic weapons programme. Server found a statistically significant excess of one type of malformation (neural tube defects) amongst local communities. Increased rates were also seen for other malformations including anercephaly and spina bifida.[11] The second study showed a statistically significant association between occupational exposure of fathers and neural tube defects in their children. For all malformations considered together, the study suggested a correlation that approached statistical significance.[12] When these studies were published the author concluded that they represented false positives, ie. a causal relationship was unlikely, as similar findings had not been reported in other populations, particularly the atomic bomb survivors.

Disease classification	Current incidence per million	Effect of 0.01 Gy per generation 1st generation	2nd generation	All
Quantifiable risk				
Autosomal dominant and X-linked diseases	10 000	15	13	100
Autosomal recessive diseases	2 500			
(i) Homozygous effects		No increase	No increase	11
(ii) Partnership effects		Negligible	Negligible	4
Chromosomal disease due to structural anomalies	400	2.4	1	4
Sub-total (rounded)	13 000	18	14	115
Unquantifiable risk at present				
Early-acting dominants	Unknown	–	0	–
Congenital anomalies	60 000	–	–	–
Other malfactoral diseases	600 000	–	–	–
Heritable tumours	Unknown	–	–	–
Chromosomal diseases due to numerical anomalies	3 400	–	0	–

Estimates of risk of genetic disease from 0.01 Gy per generation of low-dose-rate, low-dose, low-let irradiation – doubling-dose method, UNSCEAR 1986 & 1988.
Sobels F H (1989) Models and Assumptions underlying Genetic Risk Assessment, Mutation Research 212 77-89

Following Gardner's report it seems that Server may be reconsidering this conclusion. In February this year he wrote that "more attention needs to be paid to the potential effects of paternal exposure to low-level ionising radiation on reproduction and child health".[3]

He is currently conducting a case-controlled study of childhood leukaemia around Hanford in an attempt to replicate Gardner's association. Gardner, in turn, is conducting a study of congenital malformation rates around Sellafield.

At present the genetic risk estimates used by ICRP and UNSCEAR take no account of either heritable tumours or congenital malformations. If Gardner and Server are able to replicate each others findings this will provide powerful evidence that genetic risks, like cancer risks, have been consistently underestimated. □

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In this its 30th year, the Organisation for Economic Co-operation and Development (OECD) have published a report on *The State of the Environment*[1]. MIKE TOWNSLEY finds that while they are coming round to the idea of sustainable development, economic growth of member states is still their main priority.

The state of the environment

REPRESENTING only 16% of the world's population and 24% of its land mass, OECD nations account for 72% of world gross product, 78% of all road vehicles and 50% of global energy use. They generate about 76% of world trade and provide 95% of bilateral assistance. Clearly, they've got the world by the .... !

When the OECD was first convened on 30 September 1961 the idea was that through a lose coalition of nations mutual self interest would be served, and provide spiralling economic growth. Now, however, the word sustainable can be found proliferating through this and other OECD reports.

Their policies are now designed, amongst other things, to "achieve the highest **sustainable** economic growth and employment and a rising standard of living in member countries, while maintaining financial stability, and thus contribute to the development of world economy." (emphasis added)

Indeed, it is this rising standard of living which is leading to increased concern about the quality of life and therefore the environment amongst OECD populations. It is from this public concern that politicians are taking their lead; in the 1990s, they warn, "public attitudes will be very much in favour of environmental protection".

Sustainability means - never having to say you're sorry to your grandchildren - different things to different people. To the 'benchmark' Bruntland Report of 1987 it is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key elements.

- the concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; and
- the idea of limitations imposed by the state of technology and social organisation on the environment's ability to meet present and future needs."

The OECD have their own 'best-fit definition': "The ability of individuals and nations to share the benefits of economic growth and natural resource amenities in the present but also a need to consider legacy is a key element of sustainable development". The main motivation at rue André-Pascal - OECD headquarters - appears to be one of self preservation, based on the understanding that the economic well being of a nation depends not only on their own actions but on those of other nations. "An individual nation which maximises its economic growth by means which increase pollution and deplete natural resources elsewhere might not only undermine growth prospects in other countries outside its boundaries, but also see its longer term growth threatened by the interdependence of ecological and economic systems."

Essential factor

Energy they say "plays a central role in the everyday activities of citizens" and is "a major component of OECD economies, both as an industrial sector in itself and as an essential factor input to most other economic activities, whether it be agriculture, industries or services, including transport". Although the link between economic growth and energy consumption weakened during the 1970s and early 1980s, they point out that the rate of disentanglement has begun to diminish. Energy, "through its effects on the environment, is clearly one of the key variables of sustainable economic development."

OECD nations are responsible for some 36% of anthropogenic - man-made - greenhouse gasses. They appear to take as read that global warming is happening, but are unsure about how to tackle it. This uncertainty pervades the report. They appear confused and disorientated by the realisation that environmental concerns could strike at their economic growth driven heart.

They divide greenhouse response strategies into two broad categories. The first is to adapt to a greenhouse altered environment, and the second involves "stopping or controlling" greenhouse gas concentrations in the atmosphere. A prudent response would involve a combination of the two. Even if a concentrated effort to implement limitation strategies were made, "some adaption would still be necessary" due to climate change brought about by greenhouse gasses already emitted.

Over the past 2 decades OECD gross domestic product has jumped 72%, road traffic by 86%, industrial production by 72%, while energy use has only risen by 30%. This illustrates the potential for energy efficiency improvements made through technological advancement. This advancement has so far been coincidental. The OECD stresses that "there is still considerable scope at an OECD level for further improving energy intensity [efficiency] under acceptable economic conditions, and for environmental reasons this needs to be exploited".

Indeed as one member country, Canada, found out, although a 20% reduction in carbon dioxide (CO_2) would cost the government $108 billion, it would save the nation $192 billion. Unfortunately this useful example was not drawn from the OECD report, but from the Worldwatch Institute's much more accessible report on ***Progress Towards a Sustainable Society*** [2].

Moratorium

Curiously, the OECD report discusses the attitude of member states to nuclear power following Chernobyl and lists several nations which have postponed decisions on pursuing the nuclear option. Yet, the UK, which has announced a moratorium on new nuclear power stations pending a review in 1994, was not included.

They are confident that technical difficulties "facing radioactive waste management at the time most important nuclear programmes were launched in the 1950s and 1960s" have or are about to be resolved. Euphemistically, they say that policies for the safe disposal of high-level radioactive wastes have yet to be implemented. It would have been more truthful to say that policies for the safe disposal of high-level radioactive waste have yet to be found.

The probability of a nuclear reactor accident causing a significant release of radioactive products is now very low per reactor-year of operation. However, the number of reactor-years is growing

"and with them the probability of accidents; its consequences could be very serious for the workers, the population and the environment." Glibly, "Safe decommissioning of nuclear installations will also be important", is added.

The most "acute" problem identified by the OECD is not technical but one of public understanding: "Efforts have to be made to inform the public more fully in order to improve general understanding. Progress is slow, however, even though all national programmes are now devoting considerable attention to informing and communicating." When will they realise that people are not that stupid? The more people find out about the nuclear industry, the more they dislike about it.

Renewable energy sources do not receive the same 'rose-coloured' treatment. Their participation in the report is cursory. "The contribution of renewable energy sources in OECD countries remains very low ... In a few countries such as Canada, Norway and Sweden, the use of these sources increased significantly, however."

They consider the potential of these sources "for increasing their market share to be very low, essentially for economic reasons." "In many cases," runs the preamble to the OECD's dismissal of renewables, "there are technical, physical and environmental reasons which might ultimately discourage significant expansion for even economically viable renewables." And that's that!

Polluter pays

There is little in the 295 page report which justifies its claim to be aimed at "assisting member countries in the definition, implementation and evaluation of environmental policies."

The Polluter Pays Principle (PPP) receives their support. It "should continue to evolve to address new and changing environmental issues". They continue, "Regardless of how the PPP evolves there can be no doubt that integrating the costs of environmental resource use into economic price mechanisms is an important step towards ensuring that such resources are better managed for future generations".

They are also aware that future demographic changes and economic growth in different regions will lead to "a decrease in the relative importance of OECD countries in emissions of pollutants related to energy". This means that it is of utmost importance "to integrate environmental concerns into aid and development assistance policies and international technology transfer".

Yes, but what is going to be done, what does it involve?

Their confusion is evident throughout the report. They are uncertain about how to respond to the globally pervasive environment crisis, whose solutions by their very nature threaten the carnivorous economic order which feeds and is fed by the OECD. Perhaps, there is one way for this dinosaur to cheat extinction. They could change their name to the Organisation for Environmental Cooperation and Development. □

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ENERGY AND THE ENVIRONMENT: SELECTED INDICATORS

		Canada	USA	France	Western Germany	Italy	UK	Japan	North America	OECD Europe	OECD	World
Total primary energy	MTOE	250	1928	209	274	152	209	399	2178	1329	4003	7957
Requirements	% change[a]	62	22	35	16	32	–	49	26	29	30	63
Net oil imports	MTOE	-19	341	86	114	90	-38	230	322	402	958	..
	% change	-545	112	-13	-9	-5	-135	15	95	-36	-6	..
Indigenous energy	MTOE	308	1616	98	130	30	231	71	1924	822	2969	7946
Production	% change	94	10	96	6	21	128	40	18	100	38	57
Total final consumption	MTOE	159	1379	141	198	114	149	279	1538	951	2833	5549
of energy	% change	45	14	15	13	31	3	40	16	23	21	..
Electricity	TWh	504	2872	392	431	204	308	754	3376	2179	6478	11047
generated	% change	141	77	167	78	73	24	110	84	90	90	128
Energy intensity	TOE/1000 $	0.64	0.44	0.37	0.41	0.32	0.41	0.27	0.45	0.41	0.41	..
(requirements/GDP)[b]	% change	-21	-27	-16	-23	-23	-33	-31	-26	-19	-25	..
Air pollutant emissions: SO_x	1000 tonnes	3800	20700	1335	1306	2070	3600	835	24500	13200	39900	99000
	% change	-43	-27	-55	-65	-27	-42	-83	-30	-42	-38	..
Particulates	1000 tonnes	1709	6900	298	532	413	533	..	9000	4000	13000	57000
	% change	-16	-63	..	-60	25	-49	..	-57	-43	-52	..
NO_x	1000 tonnes	1943	19800	1766	2872	1570	2513	1176	21700	12700	36600	68000
	% change	42	8	34	21	11	5	-29	10	25	13	..
CO_2	1000 t. of C	124	1433	103	198	108	163	272	1557	886	2793	6256
	% change	32	19	-18	-5	17	-13	25	20	4	15	32
Waste from nuclear fuel	Tonne of heavy metals	1300	1900	950	360	–	900	770	3200	3800	6989	..

Notes: *a)* "% change" figures refer to the period 1970-1988; all other data refer to 1988 or the latest available year.
b) GDP values refer to 1985 prices and exchange rates.
MTOE: Million Tonnes of Oil Equivalent; TWh: Tera Watt hours.
Source: OECD

With Thatcher gone, a Major-Kohl alliance in charge, and the political collapse of Eastern Europe, all obstacles for a full commercial integration of Europe seem to have vanished. The backbone of industrialised countries, the energy industry, is not going to be left behind, but increase its activities towards a fully integrated network, argues SEBASTIAN KLINKE, a student of political sciences at Bremen University.

Making the connection

THE big interconnection would imply the free trade of energy products within Europe, deep into the Soviet Union and North Africa. One scenario for the year 2000 is Eastern Europe supplying the West with electricity, generated by Western-designed nuclear power stations. This, at least, is the dream of the Western nuclear industry, forced out of their own countries by the "California syndrome" (*SCRAM 81*).

This future East-West relationship would be deeply dependent on the development of a highly integrated transmission network between Western and Eastern Europe. Highly integrated means that it has to be both technically and politically accessible for large profitable transactions of electricity. As nuclear power is a child of large scale economics, its future, more than for any other generating technology, necessitates the growth of the transmission network. The massive French nuclear expansion programme during the 80s - 45,810MW of nameplate capacity - was only made feasible by the West European grid allowing France to supplement domestic electricity demand growth with export sales. In 1989 France made a net export of 40.9bn KW/h. Most other UCPTE (Union for the Coordination of Production and Transmission of Electricity) countries were more or less importing the same amount of electricity they were exporting - described as "cooperative load balancing" by utilities.

Spearhead

Currently, connections between the West and East European grids are being spearheaded in the former GDR. One direct-current (DC) link is already in operation, with four others under construction between parts of eastern and western Germany, expected to be operational by 1992-93.

Another DC grid connection exists between Austria and Czechoslovakia (CSFR). Two DC connections to the East also exist between Finland and the USSR, but between two different systems, the NORDEL (Nordic Electricity Council) and the Northern Power System of the USSR. NORDEL is the association of utilities in Finland, Norway, Sweden and the eastern half of Denmark. Finland imports substantial amounts of electricity, 4.8bn kWh in 1989, on long term contracts from the USSR.

The most important connections for the future development of the European Electricity market will be the ones between the UCPTE and the CDO (Central Dispatching Organisation). The UCPTE is the grid organisation for Western Europe, the western half of Denmark, Yugoslavia and Greece. The CDO services all east European countries that belonged to COMECON, including the southern USSR network, which stretches far into Siberia. Further DC-coupler stations are planned between Germany and the CSFR, Austria and Hungary as well as Greece and Bulgaria. Italy has already agreed to pump $800m into Hungary's grid so it can take Soviet electricity by 1995.

Sales attack

Claiming the need for new power plants to secure future energy demands in Eastern Europe, West European utilities, plant manufacturers and their representative bodies have launched a combined sales attack. They are trying to sell whole nuclear power stations under the condition that repayments are made in electricity. Most business they have done so far involves selling Instrumentation and Control (I&C) equipment to upgrade Soviet- design nuclear power stations.

Bulgaria and Hungary have already expressed their interest in Western European nuclear 'aid'. Both have well established nuclear industries. Bulgaria has 5 operating reactors and one ready to start at Kozloduy, two are under construction and two more are on order at Belene. Kozloduy-1 to -4 are early Soviet VVER (PWR)-440, Model-230s, whereas Kozloduy-5 to -6 and Belene-1 to -2 are more modern VVER-1000s.

Hungary has 4 operating reactors at Paks (VVER-440s) and a uranium mining complex at Pecs. All these Soviet-designed reactor types suffer from the same severe safety deficiencies, which led to the shutdown or halt of construction of their sister plants in eastern Germany (*SCRAM 80*). Attempts by both governments to expand their nuclear capacity have been hampered by "the present crest of anti-nuclear sentiment" within the population, but both will continue to keep the nuclear option open.

The Soviet Union itself, with the largest nuclear power market for foreign investors, still clings to its (downgraded) Long-Term Energy Programme, calling for 50,000-80,000MW of installed nuclear capacity by 2005. In reality, the central government has more than enough difficulties maintaining the present level of generation and trying to cope with environmentalist and nationalist protesters. In January 1990, they had 45 reactors operating in 16 power stations with a total capacity of 34,400MW.

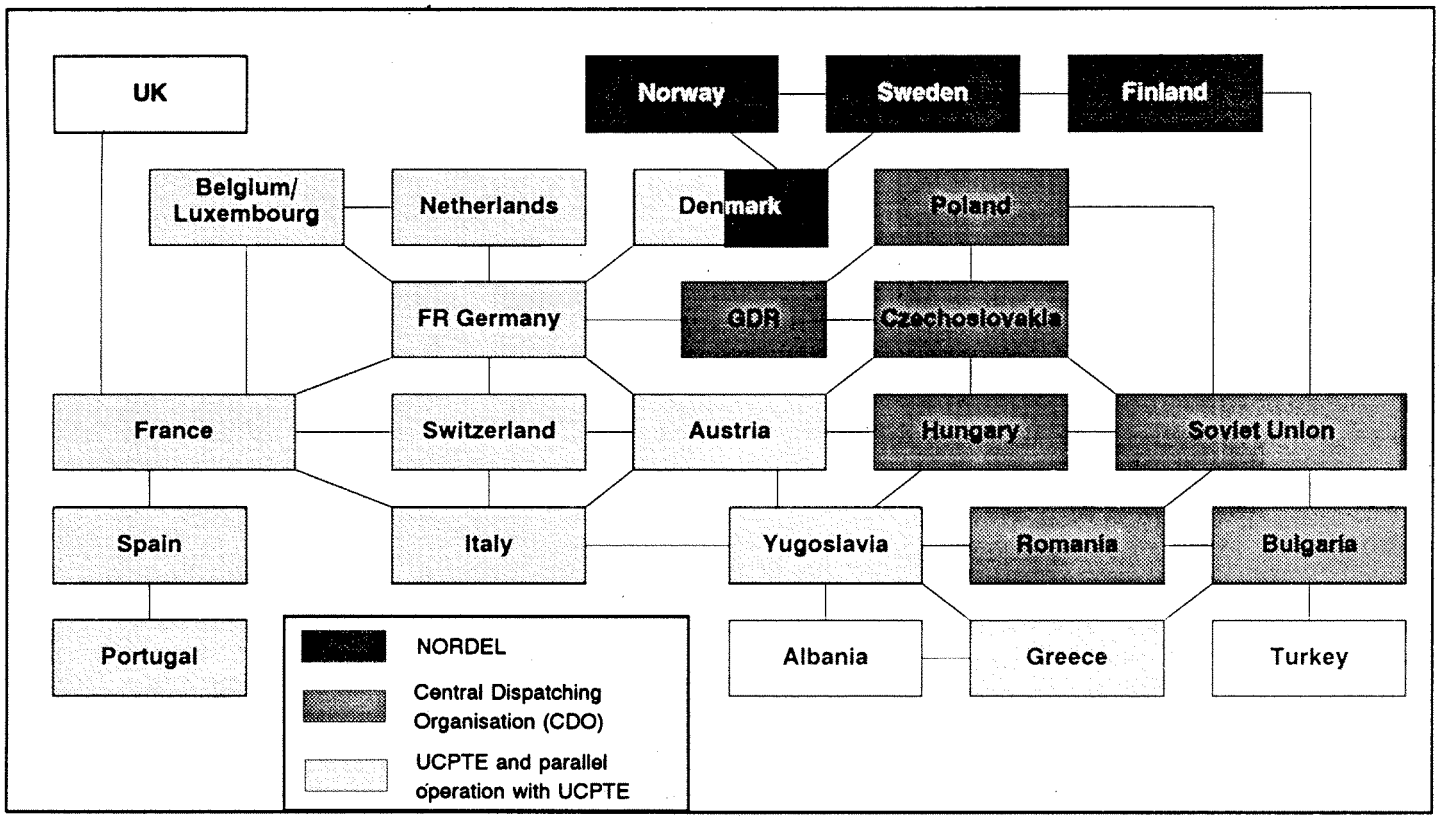
Poland and Yugoslavia have officially dropped their nuclear expansion policies. The Polish government has committed itself to a nuclear moratorium until the year 2000. The decision, taken in September 1990, meant the end for Poland's only active nuclear project - Zarnowiec nuclear power station. Zarnowiec was meant to house 4 second-generation VVER-440, Model-213, PWRs. After 9 years of work, the first two units are only 30% complete.

Referendum

Yugoslavia's only nuclear reactor, the 664MW Westinghouse PWR Krsko is due for shutdown in 1995, according to Slovenia's deputy Prime Minister, Leo Seserko, and assurances from Slovenian Energy Minister Mika Tomzio. The problem is that Croatia, owning half of the plant, is unlikely to agree to a shutdown.

Slovenia promise to put the issue to a referendum by mid-1991. This will, however, depend on how the political crisis in Yugoslavia unfolds. Meanwhile, the operator Nuklearna Elektrarna Krsko (NEK) has ordered a study on new I&C equipment for its reactor, to revamp the original Westinghouse P-2000 computer by mid-1992, indicating that it expects the reactor to operate beyond 1995.

Nonetheless, the Slovenian government has ordered technical/economic studies of its long term energy strategy for 2020.



International power transfer within Europe

Scenarios with and without nuclear will be included. Decisions will also rely on Austrian proposals for a nuclear-free energy future. Slovenia expects Austria to share half the costs of any major change in its energy policy.

Although the east European nuclear industry does not seem to be growing, there is still a significant market for west European enterprises. For future East-West energy relationships, the triangular business between the German utility Bayernwerk, the Slovakian utility SEP and the German plant manufacturer Siemens EE could become exemplary. Bayernwerk is going to pay SEP DM80m now, pre-financing electricity supplies, so that SEP will be able to pay Siemens for the I&C upgrade of its Mochovce-1 and -2. The 4 VVER-440, Model-213 reactors, under construction at Mochovce, are expected to start operation by 1995. Bayernwerk will then receive 1.4bn kWh of baseload electricity during the winter months of 1995-97.

This means electricity priced at 5.7Pf/kWh in contrast to 12Pf/kWh Bayernwerk has to pay for electricity from its own most modern nuclear plant Isar-2. Bayernwerk is said to be interested in other similar deals. The German utility is also involved in a DM250m joint venture to build the DC-coupler between the German and Czech border. Direct power exchanges will become possible in 1992.

The great danger is that East European countries will supply the West with energy not reflecting its real costs, at a time when even the French government is starting to consider including the cost of reprocessing and long-term waste disposal into its nuclear costs. None of the East European Countries has a national waste disposal policy, since reprocessing contracts have been cancelled. At this stage it is quite difficult to predict the exact scale of electricity transmissions between East and West in 2000, but it will be at a significant level, with western utilities profiting from "cheap" electricity imports. The necessary grid connections will be established, with Czechoslovakia becoming the centre for east-west exchanges, because of its geographical position and its pro-nuclear stance.

Single energy-market

The dream of an EC single energy-market may not become reality, but the foundation for free cross-border transit has already been laid. At its 29 October 1990 meeting, the EC-council of energy ministers voted into law the electricity transit right of way, "to boost cross-border sales of power between national grids". The new law has to be incorporated into the national law of each member country by 1 July 1991. The preliminary document of the new "European Energy Charter", presented by EC Energy Commissioner Antonio Cardoso e Cunha on 13 February, is particularly aimed at gaining similar agreements with East European countries and the Soviet Union.

The first two of the 8 specific areas of co-operation are "nuclear energy and the improvement of reactor security; and modernisation of power stations, interconnection between grids and transit rights for high-tension electricity". One aspect of the transit right of way is that "electric interpenetration" will destroy "the illusion of nuclear-free electricity in any one member state". Though nuclear power-free Denmark and Italy do not seem to be particularly bothered, both already importing large quantities of nuclear electricity, from Sweden and France respectively.

Future increases in cross-border power sales activities will throw a lifeline to the French nuclear industry, by increasing the load factor from its present 67%. Furthermore, the interconnection of the CDO with the UCPTE grid will encourage East European governments to invest in nuclear energy as they can sell excessive baseload capacity to the West. Eastern Europe will, thereby, help to secure the future of the nuclear industry to the year 2000.

In terms of safe energy the 'big interconnection' will help to maintain the feasibility of large scale power production in general and thereby work against efficient localised and alternative energy production. As long as power in Eastern Europe is not generated in line with West European environmental and safety standards, connecting the Western and Eastern grids will be counterproductive to the establishment of environmentally sound energy systems in Europe. □

Despite having the best wind resource in Europe, Britain is doing little to exploit the potential. MIKE HARPER, FoE's assistant energy campaigner, calls for an extension of the NFFO to support renewables and allow wind turbines to be built at less environmentally sensitive sites.

Removing the wind brakes

THE potential for developing wind energy in the UK is substantial and internationally recognised as the best in Europe. Department of Energy estimates have placed the on-shore and off-shore resource at 45TWh/yr and 140 TWh/yr respectively - around 20% and 50% of total UK annual electricity consumption. Despite these estimates, the deployment of wind energy in the UK has progressed at a snail's pace. Over the last 15 years about 8MW of wind power has been installed, equivalent to that installed in only 22 days in California and about 11% of the amount installed in Denmark in 1990.

Although the environmental impact of wind energy is substantially less than that of conventional power stations (coal, nuclear or gas), it is not completely benign, but the environmental impacts are localised, reversible and can generally be reduced by careful siting, design and operation. [1]

Wind energy use in the UK is in its infancy and there is no established national wind turbine manufacturing and installation capability. Nevertheless, under the preprivatisation public sector economic conditions, wind energy costs were directly comparable with conventional electricity generation costs. However, in the current climate, the price of electricity from wind energy is higher than from conventional fossil-fuelled power stations. Since wind energy has high, up-front, capital costs, but low operating costs, the effect of changing the 'payback periods' and 'rates of return' which are applied to a project can be dramatic. Changes as a result of privatisation in both these respects have had a negative impact on the prices of electricity from wind energy. Consequently, 'kick-start' investment such as the support of the Non Fossil Fuel Obligation (NFFO) is necessary to establish secure foundations for the wind industry. This investment is wholly justified in view of the overall environmental benefits of using wind energy, the costs of which are not reflected in current pricing methods.

Through the NFFO, the Government intends to "work towards a figure of 1,000 megawatts [of renewables] in 2000"[2]. Currently, the NFFO only applies to electricity generated in England and Wales. There is no equivalent provision for Scotland or Northern Ireland despite the fact that Scotland is estimated to have some 55% of the wind energy resource of the UK and over 8 times as much 'small hydro' potential than the rest of the UK[3].

In evidence to the House of Commons Energy Select Committee, the Government stated that "8 years seemed the appropriate period" for operation of the NFFO[4], in spite of the fact that it had originally intended the NFFO to operate for longer. The European Commission, however, did not consider that a longer period would be compatible with its principles of fair competition in relation to the effective subsidy being provided to the nuclear industry and thus forced the Government to limit the NFFO to 1998. Sir Leon Brittan, Vice-President of the Commission, speaking in the European Parliament, stated: "In the course of substantial discussions with the commission the United Kingdom authorities have agreed to change in important respects their original proposals so as to relax and limit certain contractual obligations between companies, **limiting the applications of the levy to eight years** and to the output of existing nuclear power stations and one which is nearing completion [Sizewell B]."[5] (emphasis added).

Commission concern

Proposals for the NFFO were notified to the European Commission in January 1990, in accordance with the provisions of Article 93 of the Treaty of Rome. These terms were approved as a derogation under Article 92[3] EEC Treaty on 28 March 1990.[6]

Though the Commission's concern was about the application of the NFFO to nuclear power, the UK Government decided that the same limited period should also apply to renewable sources of energy, including wind energy. The Commission has subsequently indicated to Friends of the Earth that it would be very unlikely to apply the same ruling to a renewables-only NFFO.

Currently, the Government has no plans to modify the situation. In a letter to Friends of the Earth, the Secretary of State for Energy has stated: "The Government will not be taking a view on the future of the NFFO beyond 1988 until the time of the nuclear review in 1994."[7]

Friends of the Earth (FoE) considers that the Government's decision to end the NFFO in 1998, combined with the specific arrangements for the 1991 tranche, will have severe and damaging impacts upon the nature of wind energy development in the UK.

Siting implications

In determining the economics of electricity generation, wind speed is the critical site-dependent factor. Developers therefore tend to go for the windiest sites. However, the higher wind speed sites are often of great landscape value. At the moment, as a result of the financial pressures imposed by the 1998 deadline, **there is no option but to choose such sites.**

An analysis of past and present proposals shows that, for financial reasons, developers cannot propose a wind energy project on a site with an average annual wind speed below 7.5m/s. This has the effect of heightening the potential landscape impact, thereby increasing potential planning conflict.

The primary concern relates to the relationship between wind speed and the designation of the countryside. Areas of wind speed greater than 7.5m/s tend to be found either in, or in close proximity to, designated areas such as National Parks, as Figure 1 illustrates.

Restricting wind energy development to areas greater than 7.5m/s also means that only a fraction of the exploitable energy and land area can be considered for development (See Figures 1 and 2).

Figure 2 shows that by restricting development to above 7.5m/s, only 10% of the gross land area of the UK can be considered for sites for wind farms (the 8% of land with wind speeds above 8.5m/s will almost certainly conflict with nationally designated areas and is therefore excluded from consideration).

Figure 3 shows the effect of restricting potential developments in England and Wales, in terms of available wind energy, to sites with wind speeds greater than 7.5m/s but less than 8.5m/s: only 36% of the available energy is therefore exploitable. In comparison, if areas with wind speeds between 6.5 and 7.5m/s are

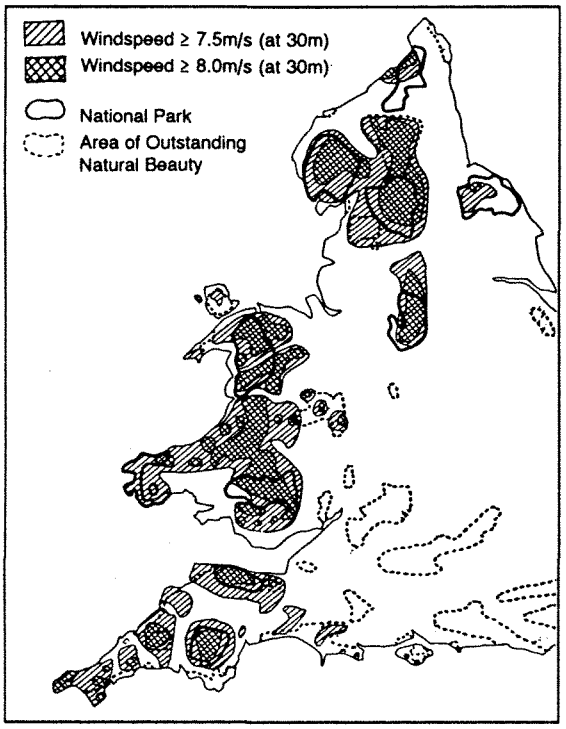


Figure 1: Areas of England and Wales with predicted wind speeds above 7.5m/s.[8]

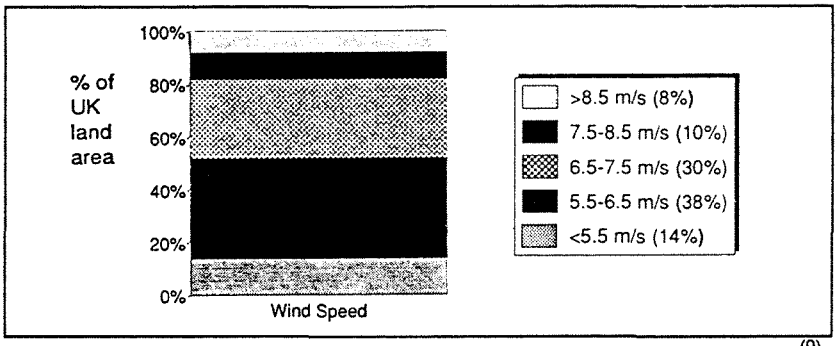


Figure 2: Distribution of mean wind speeds in UK as a % of land area.[9]

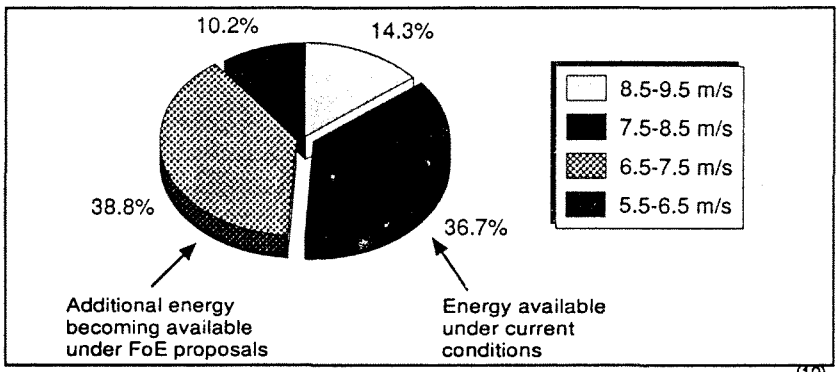


Figure 3: Available energy in England and Wales split by wind speed.[10]

included for consideration, the percentage of exploitable wind energy in England and Wales will increase from the present 36% to 74%.

Forcing wind energy developments to higher wind speed sites will result in an increase of potential landscape conflicts. This generates a negative impression of wind energy.

Recommendations

Under the present framework, only sites with a limited range of average wind speeds can be developed. Unlike in other EC countries such as Denmark, Netherlands and Germany, the financial conditions laid upon developers in the UK mean that lower wind speed sites cannot even be contemplated for development. In the longer term, the situation will prevent off-shore sites from being considered as well. This restricts developments to a relatively small percentage of land area, where landscape impacts, conflicts and planning delays are more likely to occur. It also greatly restricts the amount of wind energy which can be harnessed.

Such a policy is misguided both from a landscape perspective and in terms of maximising the development of wind energy in the UK.

In order to address this, FoE proposes a policy that would allow a wider range of wind speeds to be developed. Such a policy would help to resolve many of the siting problems associated with wind energy by making land with lower landscape sensitivity viable for development.

FoE proposes:

1 The decision to limit the NFFO for renewables to 1998 should be changed immediately and, for wind energy, it should be replaced by a system which guarantees a contract length for 15 years from the date of commissioning.

A decision to propose any changes to the 1998 deadline can only be made by the UK Government. The Government should return to the European Commission immediately for an extension of the NFFO beyond 1998 for wind and other renewable sources of energy. The Commission has indicated to Friends of the Earth that it would consider such a proposal "with a generally favourable view".[11]

2 The NFFO, in so far as it relates to renewable energy, should apply to Scotland and Northern Ireland.

Without premium prices and the support of the NFFO, the development of wind energy in Scotland cannot take place. The current exclusion of Scotland from the NFFO is a perverse anomaly, especially given that the objective of the NFFO is to "secure diversity and continuity of supply in the United Kingdom."[12]

3 The UK Government should establish a target for wind energy development, in line with other countries.

FoE proposes a target of 1,000 MW Declared Net Capacity by the year 2005 (50MW of which should be off-shore). □

Footnotes:

1. See *Developing Wind Energy for the UK*, FoE, 1990.

2. *This Common Inheritance*, Section 5.40, September, 1990. (NB: The Government has not stated whether this is installed or 'Declared Net Capacity see 11 below).

3. Calculated by the AIEP from Energy Paper 55 and ETSU Paper *Land Constraints of the Wind Energy Resource in the UK*, BWEA Conference 1990.

4. Note by the Department of Energy to Energy Select Committee, 8/5/90.

5. Official report, 16/5/1990, page 339.

6. European Commission Press Release 28.03.90 IP (90) 267.

7. Letter dated 19/4/1990.

8. From Holt et al, 1989. On-site monitoring has confirmed that these wind speed measurements tend to be over-optimistic. Sites of wind speeds of over 7.5m/s are thus more likely to be in or close to designated areas than this map suggests.

9. Adapted from Parkinson, 1990.

10. Adapted from Grubb, 1989.

11. G Thies, Head of Unit, Directorate-General for Competition, DGIV, letter to FoE, 1/8/1990.

12. Note by the Department of Energy: "Section 32: The Electricity Act - Securing Diversity of Supply in the United Kingdom".

A full briefing on this subject by Mike Harper and Marcus Rand is available from Publications Dispatch, Friends of the Earth, 26-28 Underwood Street, for £1.

The Nuclear Free Local Authorities held a conference in February on Radioactive Waste Management'. DAVID LOWRY, Senior Environmental Policy Consultant with Inspectorate Casella Environmental Ltd, presented a paper to the conference on waste management options. Here PETE ROCHE presents SCRAM's summary.

The future of reprocessing

IN January 1976 the government announced a change of policy on the waste which arises from foreign reprocessing contracts. They said future "contracts will contain an option to return the resultant waste to the country of origin." All wastes arising under pre-1976 contracts will remain in the UK.

A decade later Parliament was given further clarification about the way in which such return-to-sender contractual clauses could be operated. In reply to Austin Mitchell MP, 2 May 1986, the Government announced: "it is already planned to return all high level wastes as soon as practicable after vitrification, but in respect of some of the less radioactive wastes there may be other options worthy of study - for example, whether it would be sensible to substitute an equivalent quantity in radiological terms, of higher level wastes."

A Parliamentary reply in May 1990 set out the estimated total volume of waste arising from the pre-1976 reprocessing contracts:
High Level Waste (HLW) 100m^3; Intermediate Level Waste (ILW) 4,000m^3; Low Level Waste (LLW) 50,000m^3.

These totals include figures for Magnox fuel returned from Japan and Italy, as well as oxide fuel from Sweden. Parliament was further told that ILW from these pre-1976 overseas contracts is expected to consist of "1% of the ILW to be included in the initial inventory for the Nirex repository." The LLW from such contracts, the reply added, "will be disposed of at Drigg and not in the Nirex repository."

The amounts and fate of waste from the post-1976 contracts is somewhat complicated to piece together. Berkhout et al. in their report *THORP and the Economics of Reprocessing*, published by the Science Policy Research Unit (SPRU) at Sussex University (*SCRAM 80*), calculate that the total volume of spent fuel contracted with overseas customers since 1976 is some 3,500 tonnes (excluding the post 2002 option for a further 1,500 tonnes of German fuel). Using a standard waste production factor it is possible to derive waste volume totals for the post-1976 contracts for foreign oxide fuel. The totals are thus:
HLW 400m^3; ILW 6,000m^3; and LLW 30,000m^3.

The SPRU analysts further suggest that if a radiologically equivalent amount of HLW is returned to make up for the ILW and LLW staying in the UK, then a further 5% of HLW would have to be returned to the country of origin. Therefore, for the period 1993 to 2002, 420m^3 of HLW would be sent back within a period of 25 years following reprocessing at THORP.

We can now calculate the total volume of wastes that would remain in the UK from foreign spent fuel reprocessing contracts signed by BNFL:
HLW 80m^3; ILW 10,000m^3; and LLW 80,000m^3.

Based on figures given by the Radioactive Waste Management Advisory Committee in 1988, the anticipated waste arisings at the whole Sellafield site by 2000 are:
HLW 985m^3; ILW 69,500m^3 and LLW 249,000m^3.

Although these figures are not identical to those for the 2002 cut-off date used in the above calculation, they are close enough for a meaningful comparison.

Political problems

Volumetrically, as a proportion of total UK waste arising, these calculations show that retaining foreign wastes will not have an overwhelming effect on the scale of British waste management. However, the political problems created when the extent of the retained reprocessing wastes is realised may impinge negatively upon Nirex's plans for a deep repository.

British Nuclear Fuels (BNFL) expect the first batches of HLW to be returned to Japan in the mid-1990s. This would mean that Britain will have been storing foreign waste for at least 30 years. If the new vitrification plant at Sellafield fails to meet standards set for it, the waste repatriation may take even longer to effect.

BNFL is very sensitive to criticism that it is contributing to making Britain a "nuclear dustbin" for the world. Critics are concerned that BNFL are taking on board the responsibility of managing other nations' spent fuel for many decades hence, and the vast bulk of the waste arisings from reprocessing foreign fuel will remain in Britain forever. Moreover, increasing business for BNFL means increasing transport of spent fuel, which many equate with escalating risk.

In August 1990 Greenpeace launched a direct action campaign against spent fuel shipments. This involved environmental protesters boarding the Pacific Nuclear Transport (PNTL) ship, The Pacific Sandpiper, in the Irish Sea off Wales, en route from Japan to Barrow with 9 flasks of spent fuel destined for Sellafield. Subsequently, BNFL took out an injunction to prohibit any such repeat interference with the safe passage at sea of their transport ships, and won a legal action in the courts against Greenpeace who had to pay substantial damages and legal costs.

Roll-on

A report commissioned by Greenpeace from Large and Associates (*SCRAM 79*) also drew attention to the higher proportion of irradiated fuel that will be shipped on scheduled roll-on/roll-off cross channel ferries via Dover. Whereas only the occasional, one or two, flasks a year were imported via Channel ports prior to 1989, in 1990 37 such flasks were scheduled to arrive this way. By the mid-1990s, this traffic is predicted to increase to between 50 and 100 flasks per annum. The "Large Report" described in detail the very serious consequences of an accident at sea or in Dover harbour involving an irradiated fuel flask, especially in light of the alarming inadequacy of emergency planning arrangements.

The 1990 Trades Union Congress annual conference passed a resolution on protection of the maritime environment, which said the TUC "noted with concern the dramatic increase in the amount of radioactive waste, including irradiated nuclear fuel, being shipped into the UK in roll-on/roll-off ferries".

In October 1990 the European Parliament (EP) adopted, by a majority of 144 votes, a resolution that included a call upon the European Commission (EC) to draw up directives to prevent

the movement of nuclear waste from its place of production. They also called for an agreement to be negotiated between member states aimed at ending the transport of spent nuclear fuel between member states and the import and export of irradiated nuclear fuel to and from the EEC. The EP's Environment, Public Health and Consumer Protection Committee was instructed to draw up a detailed report on the range of concerns expressed in the resolution. Further, the EP called for an immediate ban on the use of non-purpose built ships for the transportation of nuclear fuel.

Were the TUC and European Parliament motions to be acted upon by the National Union of Marine Aviation and Shipping Transport officers (NUMAST), who moved the TUC resolution, then the substantial escalation in spent nuclear fuel imports via Dover would be halted. This would have very serious consequences for future BNFL contracts with European utilities. To date it is unclear what action will be taken in the long term, but earlier this year Rotterdam dock workers, on the advice of the International Transport Workers Federation, blocked a load of spent fuel destined for Britain because the intended carrier was not a purpose-built vessel (*SCRAM 81*).

It is also unclear what action will be taken by the EC following the EP resolution. The problem confronting the EC is that as part of its updating of radiological protection legislation within the EEC, it had, only three months prior to the EP resolution, made proposals to the Council of Ministers, that in effect endorse the continued transport of radioactive waste within the EEC, albeit with tighter controls over prior authorisation of consignments.

Spent fuel excluded

Moreover, spent nuclear fuel is excluded from this new oversight and radioactive waste is defined as "radioactive substances for which no use is foreseen". Spent fuel destined for reprocessing clearly falls outside such a definition. Thus in order to accommodate the EP's decision, the EC will have to propose a directive to the Council of Ministers that contradicts its own earlier proposals. It is likely to prove an intractable problem.

Sellafield could also be profoundly effected by the decision, in September 1990, by James Hahn, the Chairman of Scottish Nuclear Ltd (SNL), to seek ways to reduce reprocessing costs, and investigate whether it was necessary to reprocess spent fuel (*SCRAM 79*). He suggested that there was a massive stock of reprocessed uranium and

The Daily Record's view on proposals for a waste dump at Dounreay

plutonium, and that it would make sense for SNL to retain its discharged spent fuel on-site in a dry or wet store, thus avoiding transport. If required, the fuel could be reprocessed in later years, he concluded. The strong stance taken by SNL could have serious effects on THORP's future particularly with foreign contracts. If SNL and Nuclear Electric, which to date have committed themselves to reprocessing contracts for AGR fuel to 1993 and 1996 respectively, were to move to a policy of dry storage of spent fuel, there would not only have to be a rethink of the UK's radioactive waste disposal strategy, according to the *Engineer* magazine (6/12/90) but it would also lead to BNFL having to raise its future THORP charges, making it harder to win business from overseas.

Developments over the past six months indicate that the attraction of reprocessing at Sellafield has been tarnished by cost increases and by a series of critical reports on the necessity and benefits of the reprocessing option (eg CORE, SPRU and RWMAC, detailed in *SCRAM 80*).

It is probably too early to make any definitive conclusion on how this will directly effect BNFL's future operations at Sellafield. But it seems that at present it has reduced customer confidence in BNFL and the THORP project.

Storage of spent fuel at the reactor site will reduce the requirements for spent fuel and other nuclear materials transport. This could be especially significant if it curtails the international market in plutonium fuels, particularly with Japan (*SCRAM 79*).

There may be no simple solution to the nuclear waste management problem (there may even be no complex solution). The important matter is, whatever route is chosen, that the decision is taken as part of a democratic process, putting the welfare of future generations at least on a par with the welfare of our generation. An open, honest debate is the minimal part of the way ahead. □

*** Radioactive Waste Management: The Issues for Local Authorities – the Conference papers will be published by Thomas Telford. Details from Nuclear Policy Unit, Town Hall, Manchester M60 2LA.**

Greenpeace International's consultant geologist, PHIL RICHARDSON, spoke to the Nuclear Free Local Authorities Conference, in February, on Radioactive Waste Management. SCRAM's summary below shows how far behind the UK is on the management of High Level Waste.

High level waste management

IN contrast with other nuclear countries worldwide, the UK has no integrated nuclear waste management strategy. Current proposals to dispose of low (LLW) and intermediate level wastes (ILW) in a deep repository provide no solution to the problem of high level waste (HLW), or spent fuel disposal.

Although no HLW has yet been disposed of, as far as we know, examination of waste management in other Orginisation for Economic Co-operation and Development (OECD) countries illustrates how far behind the UK is, in terms of research and development.

By the mid 1970s it was decided that the safest way to 'condition' liquid HLW would be to turn it into inert glass blocks by a process called vitrification. Consequently, most disposal scenarios assume the waste to be in solid form. In the meantime, liquid HLW is generally stored in stainless steel tanks, mostly at Sellafield.

Two vitrification plants are currently in operation, at Marcoule in France and the one at Sellafield which has just come on-stream. However, the Sellafield product has yet to be approved for disposal by the regulators, Her Majesty's Inspectorate of Pollution. Plans have also been put forward to vitrify wastes at Dounreay.

It is generally agreed that spent fuel and vitrified waste must be stored for a period of at least 50 years prior to implementing a final management policy. This would allow for some short-lived but highly radioactive elements to decay to relatively lower levels, and for the heat associated with these to decline.

Over the years, several potential methods for final disposal have been put forward, from shooting canisters into space to disposing of it down deep ocean trenches. It is now agreed, within the nuclear industry at least, that the preferred option is that of deep disposal, in supposedly stable geological formations.

Until recently there were two possible scenarios in vogue: deep disposal on land; or deep disposal in the seabed, either by drilled emplacement or using penetrators dropped over the side of a ship (see diagram).

Following the decision of the London Dumping Convention in November 1990 to extend its existing moratorium on the disposal of drummed wastes to include subseabed disposal of nuclear waste, that option is now foreclosed, probably for good. As a result, the remaining option is deep disposal on land.

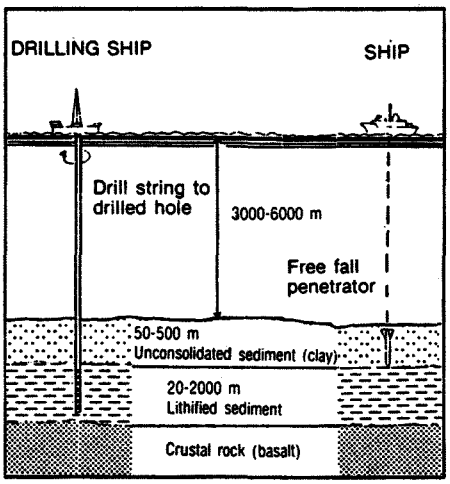
Many of the questions, which have arisen during the debate about the Nirex repository, concerning both the underlying multi-barrier concept and the lack of adequate validation of the computer models to be used in any site evaluation, also apply to a HLW repository*.

At an International Symposium on Repository Safety held in Paris in 1989, several speakers highlighted the problems in modelling the natural world adequately enough to be confident that a major unknown factor had not been omitted. Much work still remains to be done, and given the inherent complexity of the natural world, it may never be known just when enough has been done. To quote one speaker: "The more you look, the more you need to look."

Site by site study

There is no substitute for detailed site by site study, and it is that which is missing in the UK. The discovery of unexpected geological conditions during regional investigations in Switzerland, as reported in the Radioactive Waste Management Advisory Committee's (RWMAC) 11th Annual Report, only reinforces this view.

Different types of geological formations are being investigated in the many OECD countries which have ongoing research and site selection programmes for HLW disposal. These programmes involve detailed site investigations, drilling, geophysical surveying and experimentation. In many countries, underground laboratories have been established, some of which have been guaranteed to close at the end of their investigations, never to become active repositories. Although the UK is participating in some projects overseas,



such as at Stripa in Sweden, no in-situ facility exists in the UK, and as yet none is planned for HLW. All the countries referred to have national waste management authorities similar to Nirex, but only in the UK does that body not deal with HLW.

The question, which comes immediately to mind, is, are Nirex using the LLW/ILW repository as some form of Trojan Horse?

Professor Knill, chair of RWMAC, has made it clear that problems can arise from co-disposal. The highly alkaline environment needed to help stability of encapsulated ILW is not favourable to the long-term stability of the HLW glass. Knill has suggested that separate ILW and HLW repositories could be built near each other if either Sellafield or Dounreay was to prove suitable. This is open to considerable debate. Almost all of the work done by Nirex has been aimed at ILW and LLW. Their conclusions cannot simply be broadened to include HLW.

HLW should not be disposed of in a Nirex ILW repository without the necessary long-term research and development and site specific experimentation shown by overseas programmes to be esssential. A much more open public debate is necessary, examining all available options, not just that most convenient to the nuclear industry. Out of sight or out of mind is not always out of danger. □

*** See for example Phil Richardson's report, *Exposing the Faults*, published by Greenpeace and FoE.**

US Energy Plan

AFTER two years of deliberation, the Bush administration has finally unveiled its National Energy Strategy (NES). It has been dammed by environment groups as a charter for "oil-junkies" and a flashback to the darkest days of the Reagan years.

Conservation and environment appear to have joined global warming in being struck from the White House energy lexicon. Indeed drafts of the NES which were leaked a week before the 20 February publication date still contained a few minor proposals to set efficiency standards for lightbulbs and to give tax concessions to companies generating electricity from renewables. These proposals did, however, come complete with rows of superimposed X's, indicating their impending demise.

The Strategy calls for 16% more power from renewables by 2010 and an increase in research and development (R&D), especially in conjunction with private industry, but gives no specifics on how this is to be achieved. The final document espouses the free market philosophy which is all too familiar in the UK: "The NES is based on the premise that for renewables, as for other emerging technologies, investment in R&D ... is a more appropriate role for the federal government than is using taxes to subsidise the use of particular technologies." Randy Swisher of the American Wind Energy Association called the NES a "giant step backwards towards continued dependence on fossil fuels and energy vulnerability. It is one of the greatest disappointments of the Bush administration's term in office."

Political ideologies are made for breaking. Oil companies are being offered tax credits against exploration. Bush wants to cut oil imports by 3.4 million barrels per day by 2010, while increasing domestic production by 3.8 million barrels per day over the same time scale.

This jump in domestic production is to be facilitated by the opening up of the Arctic National Wildlife Refuge in Northern Alaska and areas of the outer continental shelf to exploration. Wells will only be sanctioned in the Refuge if the US Department of the Interior can give guarantee's of minimal impact on wildlife and the marine ecosystem. In the event of an accident a 5 cents per barrel tax will be put on oil to pay for the costs of a clean up. This will yield around $50 million. Yet, the cost of cleaning up after the Exxon Valdez discharged its cargo off the coast of Alaska was a staggering $2 billion - which many say is still not enough.

In an attempt to stop the rot in the US nuclear industry, the NES proposes changes in the legislation governing the licensing of nuclear reactors. The US's vocal public opposition to nuclear power is to be gagged by "one-step" reactor licensing. Secondary hearings (inquiries) following construction of a reactor but before 'start-up' would be outlawed under the NES. Such a move would overturn decisions by the US Court of Appeals which in 1989 twice ruled that the Nuclear Regulatory Commission (NRC) illegally restricted the public's rights in plant-licensing hearings. The court ruled: "The plain language of the [Atomic Energy] Act requires the Commission to provide an opportunity for a hearing to consider significant new information that comes to light after initial licensing". This is exactly what the NES seeks to prevent.

Drawing by Klaus Albrechten / Denis Martin

The development of a national nuclear waste dump is to be stepped up, regulatory reform will strip individual states of the right to veto a repository in their boundaries. Bush has also called for an acceleration of the search for safer so-called advanced reactors.

Nuclear fusion is seen as a source of secure supply, and twin goals of operating a demonstration plant by 2025 and commercial exploitation by 2040 have been set. While fusion enthusiasts are encouraged by the support, Steve Dean, president of Fusion Power Associates, comments: "It doesn't talk about how much should be spent, or where the money will come from." Nor does it mention the fact that nobody as yet knows if it is possible to achieve a net energy gain from fusion and make a profit.

Although Bush can implement over half of the strategy's 100 proposals without the approval of Congress, most of the more important elements require its sanction. Considerable horse-trading is likely as Congress takes environmental issues much more seriously than the White House. Many echo the sentiments of Tennessee Senator Al Gore, a Democrat, who described the strategy as "breathtakingly dumb".

Chris Flavin, of the Worldwatch Institute, called the NES a "major embarrassment" for Bush and promised that environmental groups will now try to force through a series of progressive energy laws in Congress.

Instead of holding out an olive branch to the increasingly powerful environment lobby, Bush has once again chosen to go to war over oil. □

US energy poll

THE results of a poll conducted on American's attitudes to energy show that the Bush's National Energy Strategy is widely out of touch with public opinion.

The poll of over 1,200 registered voters, taken in December before the Gulf War and released at the beginning of February, is statistically accurate to 3 percentage points.

Three quarters of Americans believe that wind and solar power could provide the majority of the nations energy requirements by 2000. They also believe that conservation is more important than increasing the production of domestic oil and gas.

Two thirds expressed the belief that the country is now entering an energy crisis similar to the one's experienced in the '70s.

The poll entitled 'America at the Crossroads' was sponsored by the Alliance to Save Energy (ASE), the Union of Concerned Scientists, and the Communications Consortium.

James Wolff, executive director of ASE, said: "The American people clearly possess what President Bush has so far lacked, in demanding an energy strategy based on energy efficiency and renewables, they are demonstrating long-term vision rather than short-term response to the current crisis in the Persian Gulf.

"Every day that passes without such an energy strategy is a lost opportunity. President Bush and Congress must act swiftly and decisively to formulate an efficiency-based policy that will help the United States avoid a similar crisis in the future." □

Global warming

HOPE is fading that a global convention on reducing greenhouse gas emissions can be formalised for signing at the world environment and development conference in Brazil in mid-1992, following 14 days of talks in the US.

The delegates from 101 nations gathered in Chantilly, Virginia near Washington DC, failed to agree on an outline protocol. They spent most of the fortnight quibbling over petty political issues. Dan Charles of the influential US environment group, the Sierra Club, comments "We've just wasted two weeks arguing over the shape of the table".

Two working groups were created by the conference. One will propose specific measures to limit carbon dioxide emissions and other greenhouse gasses. The other will resolve legal issues and suggest ways to transfer technology and funds to developing nations to help them conserve forests and use energy more efficiently. They will meet in Nairobi this June to discuss their progress.

The main brake on progress was provided by the US. The American delegation had to approve all changes in its position, no matter how minor, with phone calls to John Sununu, Chief of Staff at the White House. Sanunu, for example, had to be convinced to approve a final report from the conference which mentioned CO_2 as a major greenhouse gas. The US is opposed to any agreement which concentrates on CO_2.

Dr David Fisk, the Department of the Environment's chief scientist, said "The UK is disappointed that we did not make more progress. But we recognise that in negotiating this particular convention we have to accommodate a global consensus if we are going to have any effect in dealing with global warming".

Britain and other West European government's want advanced industrialised nations to agree to limits on emissions of climate-altering gasses and want these limits to be part of the convention, so far the US does not. □

Energy efficiency

ONCE again the Budget is a story of lost opportunity, with real advances in environmental policy being sacrificed to electioneering. The Chancellor has not, as had been expected, removed value added tax (VAT) on energy efficiency appliances.

Andrew Warren, the Director of the Association for the Conservation of Energy, is disappointed by the budget: "It is quite obvious that the Chancellor has no interest in improving our environment. By sending the wrong price signals to consumers, he is deliberately encouraging profligacy and environmental damage. Indeed the higher VAT rate distorts the market still further.

"Over the past year, this country has become less rather than more energy efficient by all recognised criteria. This budget makes it even more difficult to see how the Government will meet its declared target to stabilise emissions of the main global warming gas, carbon dioxide, by 2005, let alone cut back on emissions by the minimum 20% scientists recommended."

Gas and electricity bills are exempt from VAT but energy saving investments are taxed at 15%, rising to 17.5% on 1 April.

By keeping VAT on energy efficiency appliances the Government provides the lie to their White Paper on the environment which promised to promote efficiency.

The Government have done little in the field of efficiency for a decade. Over the last ten years energy consumption has been promoted rather than saving. The budget for the Department of Energy's Energy Efficiency Office and money for local authorities to improve insulation in housing have been cut.

Over the past two years investment in energy efficiency in buildings has fallen by 28%. Britain is becoming less efficient. While the Gross Domestic Product for the 4th quarter of 1990 dropped 1.1% on the previous year, energy consumption rose by 1.8%. Carbon dioxide emissions rose by 1.6%. □

Topping Cycle

A further £3.7 million is being made available by the Government to British Coal (BC) for their research programme at Grimethorpe into clean coal technology. The money will ensure that the next phase of BC's 3 year programme proceeds to schedule.

Energy Secretary, John Wakeham, said "the additional support for this financial year demonstrates the importance the Government attaches to developing clean coal technologies".

However, as noted by the Energy Select Committee (*SCRAM 79*), coal provides about 75% of UK electricity, but receives only 4.2% of the nation's energy research and development funds. A situation they find "unsatisfactory".

In particular, they focused on BC's 'Topping Cycle' research at Grimethorpe which, they say, could lead to coal burning efficiency improvements of 20% and therefore a 20% reduction in CO_2 emissions. The project's future depends on BC securing private sector finance for at least half the £28 million costs. The Committee commented: "This [condition] apparently does not apply to any nuclear R&D", and called on the Government to make money available "so far as necessary to prevent the project from being delayed by lack of funding."

The new money will only cover the next phase of work and BC are expected to find private investors for the remainder of the work. It is, however, unlikely the Government would want to suffer the embarrassment of such an internationally renowned project floundering because they refused it funding. □

Gas prices

GAS that is used to produce electricity will cost 35% more than domestic supplies according to new price increases announced by British Gas (BG).

BG are concerned that with the plethora of gas-fired power stations planned by independent electricity producers a shortfall in supply could occur, and it would fail to meet its statutory duty of providing gas to people for purposes such as keeping warm and cooking.

The announcement made on 1 May will come as a surprise to many prospective investors in the electricity industry, who were informed by Kleinwort Benson - on the behalf of the Secretary of State for Energy - that: "Combined Cycle Gas Turbine (CCGT) plant is likely to be the major form of new generating capacity constructed in England and Wales for at least the next five years. Natural gas is currently available at a competitive price for power generation."

Many independents are now withdrawing their proposals, thus giving the lie to the Government's claims that privatisation will promote competition in the electricity industry. Increased use of gas, which gives rise to less greenhouse gases than other fossil fuels, was a major component of the Government's plans to reduce CO_2 emissions. □

Holland's windmills

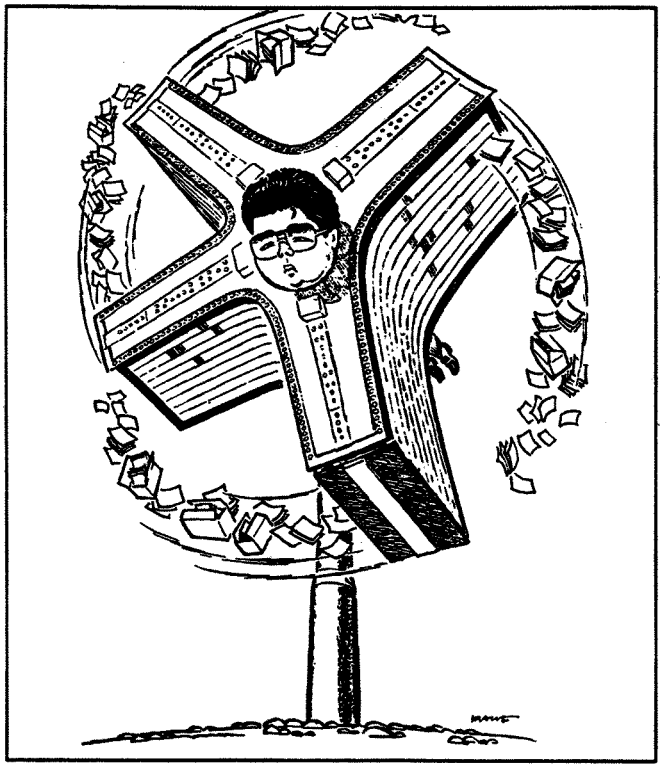
WINDMILLS are once again gaining currency in Holland. The Hague Parliament have decided to give generous subsidies for the construction of some 1,000MW of wind power.

The turbines, over 1,000 in total, will benefit from Government subsidies of 40% on the installation costs. They will produce enough electricity to supply a city the size of Amsterdam, about 10% of the country's demand. It will be the country's largest wind programme since the 17th century.

Seven provinces "have agreed to build enough windmills to generate 1,000MW by the end of the century."

Over the next 4 years, the government and energy companies plan to invest over £150million on developing energy-efficient wind turbines, which they believe will give the technology the competitive edge over fossil fuels.

Hans Alders, the Dutch environment minister, believes that when the environmental costs of fossil fuels begin to be taken into the economic equation, there will be a large upsurge in the use of the technology. The research is being undertaken by the Dutch Energy Research Centre at Petten. □



From: Windpower Monthly

Thermie contract for ETSU

A contract worth £350,000 has been awarded to the Department of Energy's Energy Technology Support Unit (ETSU) by the European Commission as part of a programme geared towards promoting energy efficiency, renewable energies, and clean coal combustion.

Awarded under the THERMIE programme it will involve "seminars, visits, literature and mail shots". It will focus on proven technologies.

THERMIE is a five year (1990 to 1994), £4 million, European Community programme designed to promote greater use of energy technologies which have yet to achieve universal acceptance throughout the community.

Dr Eoin Lees, head of ETSU, welcomed the contract saying, "We will be responsible for undertaking specific activities for the British-based campaigns. On a European scale, we will also be liaising with our colleagues on the Continent to stage industry-specific and market-specific seminars. It is a truly European initiative to which ETSU, through our experience of managing Department of Energy research and development and technology transfer programmes can make a major contribution." □

Dutch solar

FOLLOWING the success of a project which involved fitting 100 solar boilers in houses, the PEB energy distribution company of Friesland, in the Netherlands, is planning to install a further 1,000 solar boilers by the year 2000.

The earlier project carried out in 1989 provided a wealth of data and showed that solar boilers can cut in half the consumption of normal boilers.

The plan is a response to the Dutch Government's National Environmental plan which was adopted at the end of last year in a bid to tackle environmental pollution. PEB have been at the forefront of environmental action. In 1988 it was the first energy distribution company to subsidise the sale of energy efficient light bulbs; most of the other distribution companies are now following suit. □

Spanish photovoltaics

SPAIN'S Union Fenosa and Germany's RWE are planning to build Europe's largest photovoltaic power station.

To be built in Toledo, Spain, it will cost £7.2 million and come on stream in 1993. They have secured a £4.2 million grant from the European Commission and are trying to get a further £1.4 million from the European Community. Negotiations are also underway to bring British Petroleum, who have done much work on photovoltaic cell development, into the project.

The hope is that the station will reduce the strain on local hydro reserves during the hot Spanish summers.

Union Fenosa are very active in alternative energy sources, taking their lead from their Government's Renewable Energy Plan. They operate a 1.2MW wind farm on Cabo Vilana in la Corunna and are working on plans for a biomass project with the Galicia local government. □

Scottish renewables

A special package to encourage the use of small scale hydro and wind power in Scotland will be unveiled shortly by the Government according to the New Scientist magazine.

Gordon Thynne, a senior official in the Department of Energy, said recently that the Government is reviewing the Scottish situation but became coy when asked to elaborate.

Currently the Government have only allowed renewables to be promoted in England and Wales. This has been done under the Non-Fossil Fuel Obligation (NFFO) which requires regional electricity companies to buy a small amount of renewable energy and a large chunk of nuclear. This situation has caused considerable uproar in Scotland which has the best wind resource in Europe.

So far the NFFO involves some 100 projects producing just over 100MW of power. By 2000 it is the Government's intention that this will grow to 1,000MW. □

REVIEWS

Fuel Poverty: from cold homes to affordable warmth; by Brenda Boardman.

Belhaven Press; 1991, 267pp, £39.00.

This book is not useful, unless you're anybody other than the Energy Secretary, who does not think fuel poverty was a useful subject to talk about and that it is no different from any other sort of poverty. One of Boardman's main aims has been to examine just that question - whether fuel poverty can be differentiated from poverty in general, and if so, what are the implications?

By their defining characteristics, low-income households have less money available for the purchase of items, including fuel, than more affluent households. However, just because you are poor you are not necessarily fuel poor, although Boardman indicates there is a strong overlap. Of the 6.7 million households in the UK defined as poor in 1990, 6.6 million are estimated to suffer from fuel poverty. What is of more concern to the author are the underlying factors that allow the two groups to be distinguished. Such an understanding is important if you are going to tackle the problems effectively.

Boardman is keen to dispel the notion that fuel poverty emerged in the wake of the 1973/74 oil crisis, that it is only the consequence of rising fuel prices and low incomes. Instead, she stresses that fuel poverty is the inability to afford adequate warmth in the home because of its energy inefficient nature. Many affluent families would find the cost of warmth unaffordable - just as the low income families do - if they too had to occupy houses lacking insulation and were forced to rely on expensive to run heating appliances.

Just how energy inefficient a dwelling is can be assessed via the Cost of Warmth Index (COWI) set out in the book. While the formula is not new (Boardman has been promoting such a concept since 1984) this is the first time the multi-disciplinary array of evidence she has amassed in support of the COWI has been published in one place, making the book a valuable reference document for anyone dealing with energy issues and low income households.

While increasing income may overcome many of the problems related to poverty in general, such a policy is inappropriate to tackle the problem of inadequate warmth, even if it could be afforded. Boardman calculates that it would cost at least £15 billion a year in income subsidies to enable the fuel poor to heat their homes to reasonable temperatures. Such payments would only subsidise the wasteful use of our energy resources and encourage unnecessary investment in energy supply plant. It would be unacceptable on environmental grounds, and given income elasticities may still not solve the problem. She recommends a major investment programme to bring the 6.6 million dwellings up to the thermal standards of the 1990 English Building Regulations (1991 in Scotland) and to include double glazing and gas central heating. All that is needed "is the political will to take some action, commit sufficient resources, and implement an energy efficiency policy to assist low income families suffering from fuel poverty". This is asking a lot from a Government that struggles to even admit that there is such a problem as fuel poverty.

I do have some minor quibbles with the book. For instance, I don't think that parts of Chapter 2 are particularly well argued. More irritating are the occasional mistakes that have crept into the text which give an impression the book was edited in a rush. I have no hesitation in recommending the book, it updates and extends a very important debate. However, at £39 a copy, it is not targeted at the many voluntary groups which deal with the issues on a day to day basis, and that is a pity.

BILL SHELDRICK

Energy for the 1990's: a new policy framework; Nick Armstrong, Mick Cooper (Eds).

Local Economic Policy Review; 1990, 59pp, £5.00.

This pamphlet is based on the findings of a working group to develop "a coherent strategy around the aims and principles of a socialist energy policy".

I'm not sure if the publication is meant to be a report, a booklet or a manifesto; I'm not convinced the editors knew either. I say this out of frustration, the pamphlet raises your interest, but often doesn't provide you with the facts or detailed argument to take the idea further. The editorial decisions on what to include seems haphazard. We have a detailed and interesting analysis of the gas industry over 8 pages, but the phase out of nuclear power merits just one paragraph. If the case against nuclear power had been decisively embraced by the Labour movement this would be fine, but it hasn't.

The coverage on renewables could also be more detailed and clearer. I remain confused as to whether they are advocating a renewables contribution by 2025 of 20% of electricity supply or, as they state, of primary energy use - the figures don't seem to add up.

The greatest philosophical disagreement within the working group appears to have been over the renationalisation of the electricity supply industry (ESI), with views for and against given. The argument for a centralised nationalised monopoly is not convincing. It cites Electricite de France as a successful monopoly, and suggests Scotland's huge overcapacity shows that "small" suppliers need greater capacity margins.

The counter argument, surprisingly, lets the EdF claim go unchallenged, but does refute the Scottish 'example'. The failure to mention the main reason for Scottish overcapacity - Tony Benn's ordering of Torness - may be because of a lack of knowledge or of space, or it may be for reasons of politics, either internal or external.

In the battle between central monopolies and decentralisation with regulation, the latter wins the day.

The pamphlet ends with proposals for an Energy Efficiency Agency and an Energy Development Agency. These sections read like a manifesto, and are also amongst the best, both in style and content.

I remain unsure of the aims of the pamphlet; as opposed to those of the working group. Dogmatic hard-line socialists and proponents of nuclear power (and especially those who are both) will remain unconvinced. There is simply neither the strength of reasoning, nor enough detail and facts, to change many people's minds.

It is, however, reassuring to know that within the Labour movement there are ideas and thinking of more substance than their leadership portrays. A firm and unequivocal commitment to phase out nuclear power may yet appear alongside the red rose.

GRAHAM STEIN

LEPR, Department of Transport Technology, University of Technology, Loughborough, Leics LE11 3TU.

REVIEWS

Climate change and world agriculture; by Martin Parry. Earthscan; 1990, 157pp, £9.95.

The Rising Seas; by Martin Ince. Earthscan; 1990, 152pp, £5.95.

Parry's book, ***Climate Change and World Agriculture***, seeks to correlate world potential food production with pervasive scientific predictions of climate change. He does this by using such 'tools' as cost benefit analysis and high to low scenarios of impact on a range of models.

He considers possible winners and losers in food production, geographical migration of habitats and crops and a range of agricultural responses. Underlying is a bold attempt to probe fundamental issues as to whether it would, "be cheaper in the long run to mitigate the greenhouse effect by cutting carbon emissions rather than adapting to unmitigated climate change?" and "what combination of mitigation and adaption would most make sense?" These questions remain unanswered, leaving us "by no means clear whether we have sufficient evidence to determine the most appropriate course of action."

As with most authorities on the subject, the reader is constantly reminded that the greenhouse issue "embodies some large uncertainties together with potentially enormous impacts", that the dangers of procrastination mean, "the amount of warming to which we are committed will be greater and probably more costly to adapt to" and later, that the adjustments in agricultural technology and management are, so "numerous and varied ... that it is extraordinarily difficult to evaluate their ultimate effect on aggregate production". These are necessary inclusions for those who would believe we will benefit from an improved environment or climate.

Hence the main conclusion that more research is needed, appears a bit meagre. To call for more research is, of course, essential but when other actions are given less weight it can appear complacent and something of a job legitimisation exercise. There is a problem of scale here too. Whilst much work is undertaken on the problems in agriculture in the poorer countries, crucial political and social aspects, such as land reallocation, are only mentioned in passing. In short, the chapter on food security seems inappropriate – whilst we cannot yet ascertain impacts at a regional level, global food security will not, as it does not today, feed people in all regions.

Ultimately, the questions posed in this book cannot be answered within the specific limits set. It follows that, since the book serves to highlight the complexity of interactions, their possible magnitude and degrees of uncertainty, it should also ensure that the demand for reduction of emissions predominates. Any work on this issue must emphasise that it is primarily the people of the South, and those of the next and following generations who will face this legacy.

Ince's book, ***The Rising Seas***, makes an interesting comparison. Where Parry is concerned with agriculture, the focus is on inland changes; Ince is concerned with coastal impacts. His main premise is, however, that the real issue, "is not how high up the beach the high tide is coming ...[but rather] the subtle and difficult arguments about science, money, morality, people and politics" as part of a more general issue about, "the extent to which gases are emitted to the atmosphere by industry and other human activities will raise the Earth's temperature by trapping incoming energy from the Sun which would otherwise be radiated back into space."

Ince achieves this by interweaving the scientific evidence of climate change impacts – such as incursion of salt water into aquifers, loss of corals and their absorptive power exposing land beyond, and diminution of biodiversity – with specific examples from threatened countries and islands. From Barbados, Fiji and the Maldives and micro-islands such as Kiribati (with 63,000 people), from the UK, US and the Netherlands, he manages to retain the human element to this global issue.

DAVE SPENCE

Meltdown: the collapse of the nuclear dream; by Crispin Aubrey.

Collins & Brown; 1991, 188pp, £6.99.

Crispin Aubrey was one of the co-ordinators of Stop Hinkley Expansion's evidence to the Hinkley Inquiry, and the 'A' involved in the 'ABC' official secrets trial in the early 70s. ***Meltdown*** is a highly readable account of the state of the UK nuclear industry, post Hinkley Inquiry, which positively effervesces with optimism. I usually find the use of flowery language in books about nuclear power out of place, but with ***Meltdown*** it makes the reading all the more enjoyable.

Beginning with the Windscale Inquiry in 1977, and the demonstrations at Torness, Aubrey takes us through the various waste dumping fights, Chernobyl, and the Hinkley Inquiry, and finishes with the mess nuclear power has been left in following the privatisation debacle.

"The invasion of the Torness site", says Aubrey, "was a landmark in British opposition to nuclear power, the first serious example of civil disobedience. This growing undercurrent of public protest was to prove a critical factor in the crisis which eventually engulfed the nuclear power developers".

The final chapter sketches out a non-nuclear future and concludes "the most exciting aspect of the present debate ... is that the door is now open for technologies [which do not] threaten our planet with destruction".

PETE ROCHE

It's not too late to order your copy from Collins & Brown, Mercury House, 195 Knightsbridge, London, SW7 1RE. Send £6.99 (inc. p&p), and £1 will be donated to **SCRAM**.

LITTLE BLACK RABBIT

Little Black Rabbit reported in the last issue of Nuclear Electric's £250,000 sponsorship of Bristol Cathedral Choir. LBR wondered if the choir would be required to "sing the praises of nuclear power".

LBR now hears that Nuclear Electric are planning celebrations for Oldbury nuclear power station as it heads towards a record 701 days of continuous running. NE's festivities will include a performance by Bristol Cathedral Choir **on top of Oldbury's reactors!**

Planning a summer holiday, LBR spotted an advert for a holiday of a lifetime. Kievturist, a Ukrainian tour operator, is offering the chance to visit Chernobyl: to stand on the concrete sarcophagus of reactor number 3; to walk along the deserted streets of Pripyat, that once housed Chernobyl workers; and to visit the village of Kopachi where hundreds of tonnes of nuclear waste are buried. All this, and a meal in Slavutich – new, unofficial, motto, "Life is good, but too short."

Those anxious about the health implications of such a trip can be reassured. An integral part of the package is a guarantee of free medical treatment for anyone receiving a 'dangerous' dose of radiation.

Nuclear waste disposal is "so complex that it makes it almost impossible for the democratic process to be applied and it will have to be left to science and scientists to meet on an international basis to make decisions." So states a new book about Dounreay. The author, Iain Sutherland, has worked at Dounreay for 28 years and his text is liberally sprinkled, not to say saturated, with pro-nuclear opinion. In a revealing passage, Sutherland says: "The human race in general ... will just have to hope that its luck holds, and the right decisions are taken."

Scavenging amongst the dustbins of the National Nuclear Corporation a rodent friend of LBR came across a discarded consultants report. The NNC consortium - whose role in life is building nuclear power stations – were obviously not impressed with their expensively commissioned report.

On reading a copy, LBR realised why. The consultants assessed that the chances of another nuclear power station coming on stream in Britain this century were too remote to contemplate. The bad news for the nuclear industry didn't stop there. The report went on to suggest that it is likely to be 2010 before there is even the remotest likelihood of anyone considering a serious nuclear power station programme again.

Rather than accept their expensive consultants findings, NNC have decided instead to launch an advertising campaign to promote nuclear power. A case, surely, of throwing bad money after good.

Nirex received much criticism over the unscientific decisions which led them to propose Dounreay and Sellafield as possible sites for nuclear dumping. In an effort to improve their image, they have brought out a glossy schools pack, 'Safe for the future'. One section, called 'choosing a site', lists details of 5 **imaginary** sites for a waste dump – Nirex should be so lucky. The section has had to be reprinted, because Nirex got the environmental features of the sites mixed up. Maybe they should just hand the whole show over to a group of school pupils.

Three ways to promote safe energy

Three ways to help SCRAM: fill in the appropriate section(s) together with your name and address and return the form to the address below.

1 I would like to **subscribe** to the **SCRAM Safe Energy Journal**, and I enclose an annual subscription fee of:

- ☐ £13.50 (ordinary)
- ☐ £6 (concession)
- ☐ £22 (supporting)
- ☐ £100 (life)
- ☐ £33 (institutional)

Overseas:
Europe add £2.50;
Outwith europe add £4.50.

2 I would like to make a **donation** to **SCRAM** and enclose a cheque for:

- ☐ £10
- ☐ £25
- ☐ £50
- ☐ £100

other £_____

3 I would like to help SCRAM with a regular monthly donation of:

☐ £1 ☐ £5 ☐ £10 other £_____

To the Manager _____

_____ (your Bank)

Address (your Bank) _____

_____

_____

Please pay on _____ (date) the sum of _____ (amount) from my account number _____ to the Royal Bank of Scotland, 142/144 Princes Street, Edinburgh (83-51-00) for the credit of SCRAM No.2 Account 25859[illegible] and make similar payments monthly until further notice.

Signed _____ Date _____

Name _____

Address _____

_____

Post code _____ Phone No. _____

To: **SCRAM, 11 Forth Street, Edinburgh EH1 3LE**

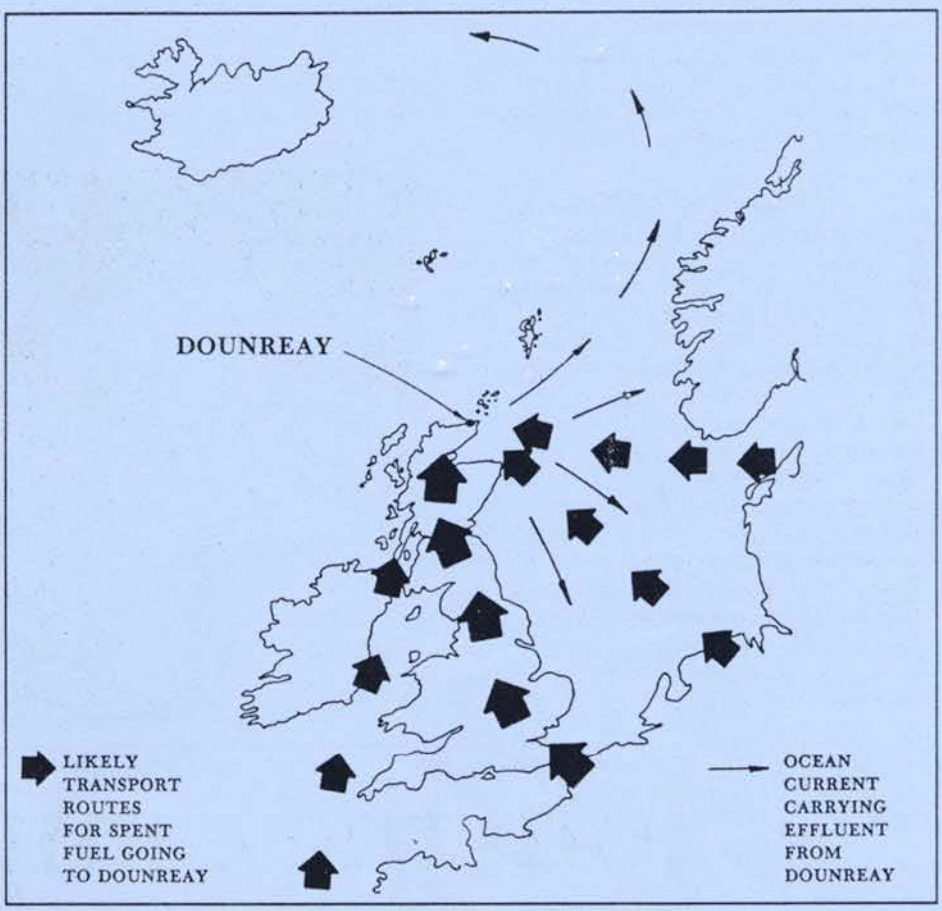
Banned in the USA - Welcomed in Dounreay

MANY countries have their own small research reactors, used to test materials, run small scale research projects, and produce medical isotopes. Most of these research reactors are fuelled with Highly Enriched Uranium fuel, which has been supplied to the reactors from the USA. The USA made it a condition of the fuel's supply that the spent fuel was returned to the USA where it was used in their nuclear weapons programme.

However, despite the usefulness of the spent fuel to the USA, they have now decided to ban its return, judging that the environmental risks of its transport alone are too great. This has left the research reactors with a problem, as they have nowhere to put the spent fuel, never having bothered to build stores to keep it in. This is a problem which the Dounreay operators are keen to exploit for their economic benefit.

The Atomic Energy Authority is offering to take the spent fuel to Dounreay for short term storage, and then for reprocessing. Already they have won four contracts from two German reactors, and they are negotiating with some fifty others from as far away as Australia. It is clear that, if left to themselves, they will happily turn Dounreay into a major commercial reprocessing plant, putting their short term commercial interests before the interests of those whose health and environment would be threatened by the transport of the fuel and waste to and from the Dounreay and by the plant's operation.

Discharges from Britain's two reprocessing plants have already given rise to international concern. The European Parliament has called for the closure of the Sellafield Plant, which has pumped huge volumes of radioactive liquids into the Irish Sea, and Scandinavian Governments have repeatedly protested about the developments at the Dounreay plant. Now that at last it is accepted that the oceans are not bottomless pits, into which we can pour our waste, Britain must stop its reprocessing work so that the discharges into the sea are turned off.



Transport: an accident waiting to happen

IF Dounreay is allowed to take on contracts to reprocess spent fuel from overseas research reactors, there will be a steady stream of spent fuel units being transported to Dounreay, much of it from continental Europe.

As the research reactors have limited storage space, they are likely to send their spent fuel over to Dounreay in small batches, making the use of road, rail or air transport likely. Just a few of the routes they very probably may use are:

* by air, flying through the crowded airspace over Britain and Europe.

* by road, perhaps crossing the Channel on a passenger carrying RoRo ferry, before probably running the gauntlet of the infamous M25, M1, M6, A74 and A9, some of the most overcrowded and accident prone roads in Britain.

* by rail, joining packed passenger trains in the Channel Tunnel before being taken north through Britain on lines running through some of our most densely populated areas.

All travel carries a risk of accident, and the chances of a large number of deliveries being made with no motorway crash, derailment, or whatever must be very small. The spent fuel will of course travel in a special vessel, designed to withstand all foreseeable accidents, but no designer can foresee all accidents or design for human error in mishandling the vessel.

Whatever the nuclear industry may claim, the transport of spent fuel to Dounreay carries an unacceptable risk to those who live beside or under the transport routes. When you hear them claim that it is safe, remember Chernobyl was 'safe' until it burst into flame, and the Titanic was 'safe' until it sank.

If they win this time – what next?

SO far the nuclear industry's plans for the development at Dounreay have been limited to the building of a dump for low and intermediate level waste from Britain and the development of commercial reprocessing of spent fuel from overseas. **This is bad enough, but if we let them get away with this, who knows what the next step would be.**

High level waste: one foot in the door?

NIREX say that they are only looking for a dump for low and intermediate level waste, and that they are not considering putting high level waste in the dump. This is of course correct, as far as it goes, since NIREX are only responsible for the disposal of the low and intermediate level wastes. However, it does not mean that, once a dump is built, the nuclear industry will not suddenly announce that the same dump will be used for the highly radioactive high level wastes. Given the fully justified high level of opposition to any proposal to dump any radioactive waste anywhere, it would be naive to expect the industry to start again from scratch, when they come to seek a dump for the high level waste. Instead they will go for the soft option, which will be to try to sneak the high level waste into the low and intermediate level waste dump, and hope no one notices. So, if Dounreay gets the low and intermediate level waste, the high level waste will soon follow.

International waste: coming to a dump near you?

AT present, the Dounreay operators, and the Government make great political capital over the clauses in their reprocessing contracts which state that the waste resulting from the reprocessing of spent fuel from overseas must all be returned to the country of origin, within 25 years of the fuel being reprocessed. These clauses commit the sender to taking the waste back, but they do not commit the British nuclear industry to sending it.

If, in 25 years time, the Dounreay reprocessing plant is sitting at the mouth of the British radioactive waste dump, it will be very tempting for the nuclear industry to offer to dispose of the overseas waste, in return for a nice fat fee, and if this is offered, who would blame the other countries for accepting this offer?

Join the campaign

NIREX and the operators of Dounreay, the U.K. Atomic Energy Authority have powerful allies in Government. Backed by seemingly unlimited funds from the taxpayer's pocket, they make a strong team to beat.

However, they can be beaten.

If the people of Scotland and the rest of Britain join the people of the Highlands and Islands in their battle against the radioactive waste dump and the importing of spent fuel for reprocessing, then NIREX and the UKAEA can be sent packing.

There are many ways you can make your voice heard:

1. You can write to your local M.P. asking him or her to raise the issue in Parliament and to Join the campaign against NIREX and the reprocessing of imported spent fuel.

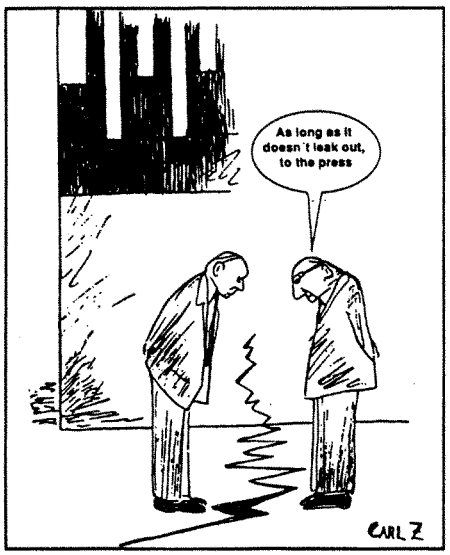
2. You can write to your Euro M.P. asking him or her to take the campaign to the European Parliament and to the European Commission.

3. You can write to the Secretary of State for Scotland, and/or the Prime Minister, voicing your opposition to the plans for Dounreay.

4. You can lobby your local council to campaign against the transport of nuclear waste and spent fuel through or over your area.

5. If you are a member of a political party, trade union, or environmental group you can persuade them to Join in the campaign.

Every letter helps write yours today



This leaflet was written by Shetland Campaign Against Dounreay Expansion (CADE) a campign group set up to oppose nuclear developments at Dounreay.

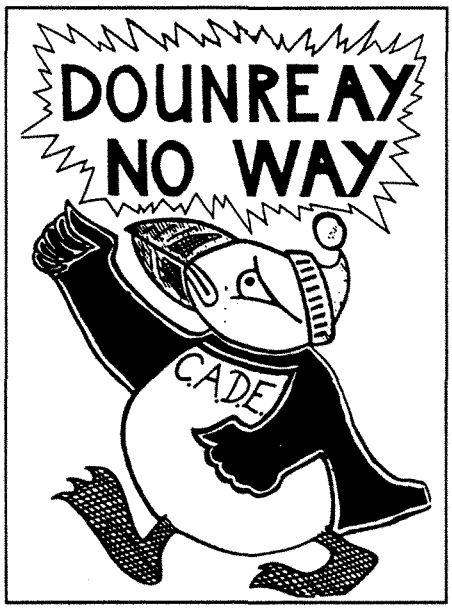
The leaflet was reformatted for the SCRAM Safe Energy Journal (Issue 82). Copies of the original 8 page A4 leaflet can be obtained from Shetland CADE. Bain's Beach, Commercial Street, Lerwick, Shetland ZE1 0AG (Fax: 0595 4082).

This leaflet printed and published by Scottish Campaign to Resist the Atomic Menace (SCRAM), 11 Forth Street, Edinburgh EH1 3LE; April 1991.

DOUNREAY

THE Dounreay Nuclear Plant, in Caithness, at the northern tip of the British mainland may seem far away, but developments at the plant could lead to its pollution landing on your doorstep.

For years Dounreay has been at the centre of British research into the mystical fast reactor, the great white hope of nuclear scientists, which swallowed over 4 billion pounds of research money, but never produced an end result worth commercial development, but now all that is changing.



After over 25 years of throwing money at the fast reactor research programme at Dounreay, the Government has decided to admit defeat and run down the programme.

This has left Dounreay's operators, the UK Atomic Energy Authority, searching for another use for the plant. The result is that they are now trying to develop the site as one of Europe's main plants for reprocessing spent fuel, the activity that creates huge volumes of nuclear waste, and they are also seeking to build a huge nuclear waste dump on the site.

Already, they are scouring the world touting for spent fuel reprocessing work for the plant. Reprocessing is the 'dirty' end of the nuclear industry, and there are many small research reactors round the world, only too keen to let Dounreay deal with their spent fuel.

If this was not enough, the U.K. nuclear waste authority, NIREX, has chosen Dounreay as one of two possible sites for the construction of the waste dump for all of Britain's low and intermediate level radioactive waste.

THE NUCLEAR DUSTBIN ON EVERYONE'S DOORSTEP

These developments have been causing widespread concern in the North of Scotland and in the communities and nations bordering the North Sea, but as yet, many in the midlands and south of Scotland, and elsewhere in Britain have not realised that they too are threatened by these plant.

This leaflet has been produced to inform you of the threat that the plans pose to you, and to ask you to join the campaign to help us stop them.

The NIREX threat

FOR 40 years the British nuclear industry has been merrily producing radioactive waste, but it has never found out how to dispose of it safely. Now, with the issue of their inability to dispose of the waste becoming more and more politically embarrassing, they have turned their attention to Dounreay, in the hope that they will be able to dump the great bulk of the waste there.

In the past, Britain disposed of its low and intermediate level waste either by tipping it on an open landfill site at Drigg, near the Sellafield Plant, or by dumping it at sea. The dumping at sea option was lost when, after a campaign lead by Greenpeace and the National Union of Seamen, it was prohibited by International Convention.

In 1982, the Nuclear industry set up NIREX to find a better way of getting rid of the low and intermediate level waste, and, after a series of false starts when public opposition forced them to abandon plans to bury the waste in worked out anhydrite mines or in shallow pits in clay soils, NIREX chose to investigate the construction of a deep 'repository' (nuclear-speak for 'dump') in the rock under either Sellafield or Dounreay.

What they propose

The dumps which NIREX propose for Dounreay will be similar in construction to a coal mine. The dump will consist of a series of underground caverns, which may run out under the seabed, reached by one or more vertical shafts. The radioactive waste will be taken to the site, packed into drums, taken below ground and concreted into the caverns. Once it is there, it will be virtually impossible for man to take it out again.

NIREX argue that the waste will be contained by a series of barriers: the steel containers; the concrete in the caverns; the rock around the caverns; and even the sea itself. They say that this will ensure that any leakage is insignificant. However, independent geologists have challenged this, saying that such a dump could not be guaranteed against unacceptable leaks. They say that there is insufficient knowledge on such factors as the effect of the caverns on the rock structure, the speed at which ground water moves through the ground, the behaviour of the radionuclides in the waste, and what happens to the gas which will be generated within the waste itself.

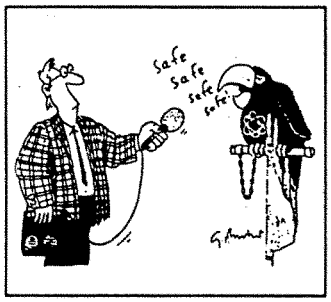
If a dump is to be 'safe' it must be capable of holding the waste for many tens of thousands of years. The fact that the dump may not leak much radiation into the environment within our lifetime is not justification for accepting it. We have a responsibility to many generations to come, and we cannot cut corners so that they inherit the nightmare of a leaking waste dump.

REPROCESSING: nuclear waste management

REPROCESSING is the chemical treatment of spent fuel from thermal nuclear reactors, the type of reactors used to run most nuclear power stations and research reactors. In the process, uranium and plutonium, along with other fission products are removed from the fuel, and huge quantities of radioactive waste are produced.

While the volumes may vary for different fuel types, typically the reprocessing of 1 cubic metre of spent fuel produces about 1.5 cubic metres of high level waste, 10 cubic metres of intermediate level waste and 150 cubic metres of low level waste.

Up until recently, reprocessing was seen by the British nuclear industry as a vital part of their waste "management" strategy. This was because the recovered plutonium was required to run the fast reactors which were to answer most of Britain's future energy needs. Even before the fast reactor programme was axed, it was debatable whether the production of this plutonium could justify the creation of huge volumes of waste, and now that the fast reactor effectively has been abandoned, there can be no possible justification for reprocessing.



The alternative to reprocessing, is to store the spent fuel in its original form. While some of the older designs of fuel rods do pose storage problems, the fuel from most modern reactors, can be stored indefinitely after its removal from the reactor. This is the course that some research reactors are taking, and there is no reason why the reactors which want to send their fuel to Dounreay cannot do the same.

While the solution to the eventual safe storage of radioactive waste remains uncertain, it is madness to continue to reprocess spent fuel. Britain already has a massive radioactive management problem, NIREX predicting that by the year 2030 the British stock of low and intermediate level waste will have a volume of 1.75 million cubic metres, and it makes no sense whatsoever to keep on adding to the problem. In addition, if the reason for importing spent fuel from overseas research reactors is because they have no room to store their spent fuel, how are they going to store the much greater volume of waste from their spent fuel, which they are supposed to take back after the fuel is reprocessed?

100% SAFE ROCK MAY ONLY BE FOUND IN THE BRAINS OF THE NIREX MEN

WHAT IS RADIOACTIVE WASTE?

High level waste: this is the highly radioactive liquid left over from the reprocessing of spent fuel, and, if it is not reprocessed, includes spent fuel itself. This waste is heat producing, and has to be stored in tanks with cooling systems to keep it from overheating. This waste will remain too dangerous to dispose of for at least 50 years after it is produced, so as yet none in Britain is ready for disposal. At the moment there are no definite plans for the disposal of this waste - or none that the industry will admit to.

Intermediate level waste: this is moderately radioactive material, such as the cladding off old fuel cans. This material is sufficiently radioactive to have to be shielded to protect people from exposure to its radiation.

Low level waste: this is slightly radioactive material, such as clothing contaminated with radioactive spills, or some sections of the structure of old nuclear plants.

How will the waste get there?

IF Dounreay is chosen for the dump site, the waste will have to get to the site from a number of locations in Britain. Most would come from the Sellafield site in Cumbria, where about half the total volume of the British waste is produced in the reprocessing plant. The rest would come from various other sites spread around Britain, in particular from the many old nuclear power stations which are due to be taken out of service and dismantled.

NIREX's own figures show that about 100 lorry loads of waste, (or 15 train loads), would arrive at the dump every week. This is the volume of traffic, which week after week, year after year, would have to travel the length of the country, to reach the site. With such a high number of trips a year, accidents will happen, since the nuclear industry is not immune to road or rail accidents. The result is that people living along the many traffic routes will in effect be forced to play a prolonged game of Russian roulette, never knowing when the disaster will strike.

The Highlands & Islands resist!

THERE can be little doubt that NIREX chose the Sellafield and Dounreay sites for reasons other than their geology. Given their history of rejection by the other communities on whom they have tried to dump the waste, it is not surprising that they turned to two areas which already have a high level of economic dependency on the nuclear industry, in the hope of a friendlier welcome.

However, if NIREX had hoped for an easy ride at Dounreay, they must be disappointed. They have been opposed by a wide cross section of opinion in the Highlands and Islands. So far opposition has come from, among others, Highland Regional Council, Caithness District Council, Shetland and Orkney Islands Councils, Highlands and Islands MPs, political parties and environmental groups. Even in Caithness, where the prospect of jobs was supposed to buy NIREX support, a referendum found that NIREX was opposed by a thumping 74% of voters.